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EDITORIAL NOTES

STEEL FOR THE GAS INDUSTRY

THE supply of iron and steel is naturally a question which has greatly exercised the mind of the Gas Industry ever since some form of control became necessary on the outbreak of war last year. Recent changes in the system rendered the position somewhat obscure even to many who were vitally interested in the matter, and it may be helpful if we give the results of enquiries we have made with a view to informing ourselves of the actual situation.

Broadly speaking, during the war of 1914-18 there was always competition between the services and industry for such steel supplies as were available; priority certificates were required for all steel purchases, and in what might almost be called the general scramble there was not only insufficient steel to meet industrial demands, but even at times a shortage for the Services also. Under the new system which has recently replaced the licensing scheme started last September, the principle has been introduced of allocating available steel supplies in certain proportions between the Services and industry. Thereafter arrangements come into force by which the needs are assessed of separate groups of industries, to ensure that each, even if it cannot obtain enough for normal—i.e., peacetime—requirements, at least will know that a restricted quantity has been allocated for its particular purposes.

Steel rationing has, in effect, superseded the licensing system, and when the new scheme is in full operation next month it will undoubtedly result in a more equitable distribution of the available steel supplies, and help to avoid delays in delivery. The claims of each Government Department, the public services, and each section of industry upon the available supplies have been examined, and there has been an assessment of the proportionate requirements of each class of consumer in the light of the experience of the past six months and of probable future departmental and trade needs. All the consuming interests have been grouped under Government Departments which, in conjunction with the Iron and Steel Control, will be responsible for regulating the supplies of finished steel allocated to the respective consumers for whom they are made responsible. Naturally the interests of the different industries have been entrusted to Government Departments which have a fairly intimate knowledge of their relative importance and individual requirements, and the Departments will in future work to a rationing scale and issue their certificates knowing the limits to which they are required to work. The Gas Industry comes under the control of the Board of Trade, and although we understand the amount of steel that has been allocated to it is naturally much less than its normal demands, there will be no fear of inequitable distribution when it is realized that the Department of Gas Administration, with its intimate knowledge of the Industry, has been entrusted with the operation of the scheme. No figures have been disclosed, but it is perfectly clear that the demands of the Fighting Forces have left industry with less steel than it desires. One function of the distribution scheme, therefore, will be to discriminate between absolutely essential purposes and what might be termed merely *desirable* purposes. For that reason ordinary development work, as we understood it prior to last September, cannot proceed at its peacetime rate, but, so far as we have been able to gather, every effort will be made to supply the essential requirements of the Gas Industry and ensure that its high efficiency shall not be impaired. Shall we say, for example, that gas making plant would not be allowed, for lack of material, to become derelict and so endanger maintenance of supplies. Nor, probably, would supplies be refused for construction of new plant to supply additional gas for essential war purposes. On the other hand, a claim that replacement or modernization would enable an undertaking to reduce production costs would be likely to receive scant sympathy at the present juncture.

HOW TO OBTAIN SUPPLIES

FROM the point of view of the contractor, the steel requirements of the Gas Industry fall into three categories: Main contracts, maintenance and repairs, and small orders, and we have heard the feeling expressed that, while the first two are more or less adequately catered for by the new scheme, the third is in need of further consideration in order that stocks of steel may be readily available for the execution of any of the hundred and one minor jobs that arise on the works and yet are not strictly work of repair or maintenance. The impression is that the procedure is too cumbersome to meet the case of these smaller jobs, and there are contractors who would like to have permission to lay in certain stocks of steel which they could use for these purposes. So far as we have been able to explore the application of the scheme it seems clear that, in the case of main contracts, it must be proved that the proposed work is in the national interest and that it is not merely planned for the purpose of saving, say, a penny per therm on working costs over the next three years. It should be clearly understood that applications for the allocation of steel in such instances must be made by the gas undertaking and not, except in special circumstances, by the contractor, and should be addressed to the Director of Gas Administration, Board of Trade, 26, Chapter Street, London, S.W.1. There will, we are confident, be a reasonably wide interpretation of "national interests," and proposed works will be judged not merely by their relation to any immediate military demand, but on the basis of public utility in its broadest sense.

Similar principles will be applied to applications for steel for "small jobs" and for repair and maintenance work. It will probably not be sufficient for an applicant to say that in any case a particular piece of plant was due for replace-

ment within the next two or three years, and therefore he proposed to get on with the job. Where work, either by way of small contract or repair, is proved to be necessary in order to prevent a lowering of the efficiency of a works, every effort will be made to find the necessary steel. Gas undertakings must apply for their steel requirements for small repairs and minor maintenance purposes for each of four periods (covering the four quarters of the year), and they will be required to state the tonnage of each class of finished steel required, the period during which delivery is required, and give evidence in support of the application showing that the work for which the steel is sought *cannot be postponed or modified* so as to require less steel.

So far as the manufacturers of gas appliances are concerned, every effort will, we understand, be made to satisfy reasonable requirements; indeed, one of the first steps in assessing the demands of the Gas Industry as a whole was to invite the members of the Society of British Gas Industries to provide information as to their expected requirements. It does not follow that they will get all they have asked for; there will undoubtedly be a very definite measure of rationing, under which replacement of the positively unusable appliance beyond repair will certainly be regarded as more important than that of the merely old-fashioned. There will, however, be an endeavour to treat the makers as generously as the prevailing circumstances will allow, and we can be sure there will be no distinction between big firms and small, provided they can make out an equally strong case for their steel requirements. They would like to be able to budget for some time ahead, but not even the controlling Departments are able to foresee the trend of available steel supplies as the war proceeds, and the only assurance makers can have is that they will get a square deal, and as generous treatment as the situation from time to time permits.

PERFORMANCE OF GAS WATER HEATERS

A USEFUL Paper which gave rise to a full discussion was given at a Meeting of the London and Southern District Junior Gas Association this month by Mr. J. E. Cooper, of the Gas Light and Coke Company. The Paper and part of the discussion will be found in the "JOURNAL" to-day. The subject was the instantaneous gas water heater—features affecting its performance on the district—and the Paper, a thoroughly practical one which we know will be studied with profit, was packed with useful information and pertinent observation. The modern instantaneous water heater with its several automatic controls and safety devices is a complicated mechanism compared with its forerunner of a comparatively few years ago. There is, in brief, more to go wrong, but there is no need for anything to go wrong on the district provided the fitter has (*a*) a thorough knowledge of the component parts of the heater, such as baffler design, automatic gas and water valves, gas and water governors, thermo cut-offs, and the like; and (*b*) a proper grasp of correct fitting practice. It is true to say that incorrect fitting has caused more difficulties in the past than have inherent defects in the appliances themselves. With these two provisos, the consumer may be assured of a gas water heating service quite remarkable for its efficiency, speed, labour-saving, automaticity, and instant availability.

Given good fitting practice, knowledge of what water-heads, for example, are required to operate different types of valve, of the effect of varying water pressures on the performance of the appliance and therefore on the satisfaction of the consumer, much can be done, if not all, by laboratory bench test to forecast the behaviour of a gas water heater when installed on the district, and to arrive at, too, the likely intervals at which appliances of different types working under different conditions will need to be maintained or "serviced." In regard to bench testing, the Author of the Paper to which we refer has had enviable experience in the Watson House Laboratories, and though we do not intend to refer here in any detail to the several points about testing and correlation to district performance with which he dealt with admirable conciseness in his contribution, there are one or two simple observations to which we would call attention because they are apt to be overlooked. In regard to automatic valves, for example, the maximum water temperature rise, which on a given heater is determined by the minimum flow at which the valve operates, is occasionally the cause of difficulties to district staff. Naturally the seasonal variation in main water temperature is a major factor in this respect, but is it generally appreciated that, due to friction, less force is required to keep a valve open than to open it? Thus the maximum temperature rise is obtained with a closing valve; and this means that in practice the hottest water is obtained by opening the tap until the gas is fully on and then closing it slightly.

Then there is unsatisfactory performance of non-storage heaters due to fluctuating water pressures—as the Author remarked, the desirability of fitting gas governors wherever possible is well understood, and he did not discuss this matter. A good tank supply is in effect governed; the inlet water pressure to the appliance is steady. With mains supply, however, wide variations in pressure may occur; hence in such circumstances the desirability of including a water governor. Heaters are now on the market which are specially designed for mains fixing and have water governors as integral parts. How such governors are tested for performance was outlined by Mr. Cooper in his Paper, which he concluded by a section dealing with life tests employed in the Watson House Laboratories to ensure satisfactory district performance, and in which he was careful to indicate what such tests on instantaneous gas water heaters do not show.

The laboratory methods described by Mr. Cooper, and the tests carried out with the same object in view in the laboratories of other gas undertakings and in those of the manufacturers of the appliances concerned, have done a very great deal indeed to raise the standard of appliance design to the benefit of everyone concerned—not least to that of the consumer. But for ultimate satisfaction with gas for instantaneous water heating a new and improved fitting technique is called for; and this as yet, we suggest, is not universally applied.

FUEL FOR GAS PRODUCERS

WE give full marks to the British Coal Utilization Research Association for directing their energies so thoroughly and so conspicuously on the use of producer gas as an alternative to petrol for motor transport. We think that this Association has, within a short time, added appreciably to our knowledge of the use of producer gas for this purpose, and the application of suitable types of fuel—which, of course, is an all-important factor. Its work has given rise to useful—and, we suggest, enviable—publicity. Well-directed enthusiasm does give birth to Press comment. Whether such comment may be immature is not for us to say.

There is no doubt about the enthusiasm of the B.C.U.R.A. in regard to mobile gas producers and the fuel to be used in the approved equipment. We have published in the "JOURNAL" the Association's specification for transport producer gas fuels, which specification is at the moment being considered by a British Standards Institution Committee representative of the motor trade, the operators' associations, fuel interests, and others with a view to its issue as a British Standard. Now the Association is busy investigating the factors involved in the national distribution of producer gas fuel, and is seeking the help of garages and commercial vehicle users in order to ascertain what their requirements are likely to be, the point being that no sales machinery exists which can be used for the retail distribution of producer gas fuel at the roadside.

B.C.U.R.A. looks ahead. In a recent document it states:

"Later on, when the gas producer vehicle becomes a commoner sight on our roads, some form of coal pump will no doubt be used, but for the present we shall have to be content with less expensive methods." The Association envisages arrangements for the fuel to be available at key points throughout the country, and the fuel "must be expected to cost more than coal or coke which comes directly from a pit, coke oven, or gas-works." No retail price has yet been decided, but we learn from the Association that the indications are that it will be about £6 per ton for normal fuels with an extra charge of about 7s. 6d. for those which come under the category of "specially dried" fuels. This, we understand, will be a national price for the whole of England, Wales, and the South of Scotland, independent of the distance from the colliery or carbonization plant, and the equivalent of one gallon of petrol will cost about 9d.

Document No. PGF/57 has now been issued, under the ægis of the Mining Association of Great Britain, to road operators. This is a formidable questionnaire—an appeal to the haulage industry "to assist in broadening the voluntary use of producer gas by private enterprise before it becomes a matter for compulsion by the Government." It is a questionnaire indeed, but speaks in unmistakable terms of the hope and audacity of B.C.U.R.A. in the ultimate outcome of its work on the use of solid fuel for motor transport. It is likely to give a headache to every road operator who receives it. The returns will certainly give headaches to those entrusted with the duty of their classification and constructive analysis. In these days of paper restrictions and pulp prices (the questionnaire runs to four foolscap folios) it is an example of optimism—and, maybe, optimism not entirely misplaced.

What, of course, we are primarily interested in in this movement is the suggested price of producer gas fuel. A selling price of £6 or £6 7s. 6d. a ton for carbonized fuel would not, on the face of it, come amiss to gas undertakings. Such a contemplated price ought to be capable of covering one or two overheads resulting from alkali activation of coal or coke, or some modification of normal carbonizing practice to produce solid fuel having the requisite properties for motor transport. We are not sure that the Gas Industry can afford to neglect possible developments in this direction, while at the same time concentrating on the sales development of gas coke as ordinarily produced—domestic sales, industrial sales, sales for agricultural purposes (the potential field here is very great), and direct sales also for use in the steam driven motor transport vehicle.

EFFICIENCY IN FACTORIES

AT this time the greatest possible industrial productive effort is demanded. Many of the factors influencing continuous efficiency are summarized lucidly in a report just issued by the Medical Research Council of the Industrial Health Research Board. The report, "Industrial Health in War," is an admirable epitome of research findings capable of immediate application in furtherance of the national effort. Work and fatigue, accident prevention, sickness absence and labour wastage are among the aspects considered. These have their application in the Gas Industry and its constituent firms, and the recommendations made cannot, in the interests of efficiency, be neglected. From the Industry's point of view, however, greatest interest attaches to the sections in the report dealing with lighting and vision, and heating and ventilation, for it is in these spheres that the Industry has such power to help. Naturally the report is quite impartial. It is concerned not with the type of lighting or heating agent employed, but with the comfort effect—which means health and working speed—of adequate lighting and heating on the worker; and it is to the recommendations in this regard that we would call attention. Their importance, we think, needs no emphasis.

Good artificial lighting means both an ample amount of light for the task in question and a proper distribution of light. Gas lighting, it is generally agreed, is kindly to the eyes, and its provision in "ample amount" is economical. As for the science of distribution, this has been developed to a high standard within the Gas Industry, which is equipped with facilities and trained staff to offer assistance and advice to factory owners and industrialists. The Industry understands that light distribution should be such that glare is avoided, that the surroundings as well as the work are well illuminated, and that there are no troublesome shadows. To satisfy such conditions, planning should be in the hands of lighting specialists, and these the Industry possesses. Inadequate illumination is a thief of time. It slows down performance and the risk of accident is increased. Investigations in several industries have shown this, and the fact that an illumination which "looks good" may in truth be far from adequate for the performance of certain tasks. Illumination values recommended in the report are: For rough work, chiefly involving gross visual perceptions, 2-4 foot-candles; for medium work, involving discrimination of fairly small detail, not being in very low contrast or rapid motion, 4-10 foot-candles; for fine and very fine work, 10-100 foot-candles. Again, the ratio of local to general illumination should not exceed 10 to 1. The importance is emphasized, too, of the proper maintenance of the equipment for artificial lighting. It is known that gas lighting units require a minimum of maintenance and that the falling-off in light output throughout mantle light is very small indeed.

Moreover, as we have pointed out before in these columns, gas lighting is closely associated with heating. The extent of the radiant heat obtainable from a gas light is in the neighbourhood of 30%. With factory illumination to a level of 5 foot-candles, from 30% to 40% of the total heat requirements may be supplied by the gas lighting. With an illumination level of 15 foot-candles, the contribution of gas lighting could amount to about 90% of the heat requirements —and gas lighting promotes air movement. This question of air movement is dealt with in the report. Adequate air movement, it is stressed, is necessary to provide an invigorating atmosphere. The Gas Industry has always stood out for warmth coupled with adequate ventilation, and it has undertaken numerous investigations into the problem. The report recommends a ventilation in factories at the rate of not less than six air changes per hour, and considers that a rate of fresh air supply much below 1,000 cu.ft. per person per hour is inadvisable. As for air temperature, winter temperatures recommended are, for very light work 65° F., for active yet light work 60°-65° F., for work involving more muscular exertion 55°-60° F.—and "overheating" should be avoided. Gas is susceptible to nice thermostatic control; it is a form of heat energy which can be easily and accurately regulated. Some of the recommendations made in the report are more urgent and more immediately practicable than others. The immediately practicable ones undoubtedly cover the suggestions put forward in regard to lighting and to heating and ventilation. All engaged in wartime industry will profit by a study of this emergency report, which is obtainable from H.M. Stationery Office, price 6d. (by post 7d.).

Students and Reserved Occupations

As will be seen from our news pages to-day, an amendment has been made by the Minister of Labour and National Service to the schedule of reserved occupations. This is the result of joint representations by The Institution of Gas Engineers and other Chartered Engineering Bodies. The matter was raised by the representatives of the Institution on the Engineering Committee of the National Service Central Register in the Autumn of 1939, since it was realized that, unless arrangements were made for engineering students to complete their course of training, their value to the technical services of the Armed Forces of the Crown and to industry would have been greatly diminished and, in consequence, as at the end of the last war, there would have been a big gap between those who had completed their technical education and were already within the schedule of reserved occupations, and those who came forward for training at the end of the war. As a

matter of fact, the seriousness of this big gap in trained personnel, which occurred at the end of the last war, is still being felt. With the new arrangement the difficulty should be greatly diminished if not entirely overcome, to the great benefit of those who may subsequently serve with the Armed Forces and to industry generally.

Those applying to come within the schedule of reserved occupations should be Students of the Institution and within two years of completing their final course of study. Applications for Forms for election to Studentship should be made to the Secretary.

Personal

Mr. T. E. BANKS has been appointed Chairman of the Gas Committee of the Kirkby-in-Ashfield Urban District Council, Notts.

* * *

Mr. A. T. HARRIS, Secretary and Manager of the Great Wigston Gas Company, has been appointed Chairman of the Wigston Urban District Council.

* * *

Mr. RAYMOND PRINCE, General Manager and Secretary of the Peterborough Gas Company, has just undergone an operation in Guy's Hospital in connexion with his fall on Feb. 20, when he broke two bones in his right forearm. On April 8, he was operated on by a specialist and he is now progressing satisfactorily, but it is expected that it will be at least a fortnight before he is able to leave Guy's.

* * *

The wedding took place at Wolverhampton on April 11 of Mr. ARTHUR G. CRANMER and Miss Marjorie M. Appleby. The bridegroom is the youngest son of Mr. W. G. S. Cranmer, Engineer, Manager, and Secretary of the Willenhall Gas Company, and holds the position of Assistant Manager to that Undertaking. Among the wedding presents was a clock from the staff and employees of the Willenhall Company.

* * *

The Officials of the Sunderland Gas Company met on April 18 in the Board Room of the Company to make a presentation to Mr. J. E. METCALFE, late Chief Clerk in the Distribution Department, who has recently retired after 50 years' service. Mr. C. F. Barrow, Distribution Superintendent, occupied the chair, and Mr. C. C. Walmsley, General Manager and Secretary, made the presentation, which consisted of a gold watch, suitably engraved, from the staff, and a cheque from the Directors in recognition of Mr. Metcalfe's long service.

Mr. Walmsley and Mr. Barrow spoke in eulogistic terms of the long and honourable service which Mr. Metcalfe had rendered to the Company, and Messrs. W. L. Robertshaw and G. Young also spoke of the happy relations which had always existed between Mr. Metcalfe and his colleagues, who wished him a long and happy retirement.

* * *

At the annual meeting of the Market Rasen New Lighting Company last week, Mr. C. H. Holland (the Chairman), presented to Mr. and Mrs. J. GREEN a sterling silver tea-set to mark the fiftieth anniversary of the association of the Green family with the management of the Undertaking. He recalled that Mr. C. Green was Gas Manager until 1906, and was then succeeded by Mr. J. Green, who carried on until 1934. It was then that Mr. C. R. Green, the present Manager, succeeded to office, while Mr. J. Green carried on certain secretarial duties.

Obituary

Mrs. Davies, wife of Mr. D. WALTER DAVIES, Engineer and Manager of the Tredegar Urban District Council Gas Department, died at the Prince of Wales Hospital, Cardiff, on April 16.

* * *

Mr. TIMOTHY DUXBURY, a former Oldham Corporation Gas Engineer, and brother of Mr. Thomas Duxbury, Gas Engineer and Manager at Darwen from 1877 to 1895, died on April 18, at the age of 79. Mr. Duxbury was a native of Darwen, receiving his early training in the Gas and Water Departments at Darwen and Widnes. He was Gas Engineer and Manager at Middleton before being appointed Gas Engineer at Oldham in February, 1902, in which capacity he served until March 31, 1927. Mr. Duxbury then left to join his younger son in business. He was a past-President of the Manchester District Gas Association and a life member of the Manchester and District Junior Gas Association.

Letters to the Editor

Multi-Point Water Heating

SIR,—Our attention has been drawn to a letter under this heading in your issue of Feb. 14, from Dr. Bernard Friedman.

Dr. Friedman is apparently afraid that, arising out of an article appearing in your issue of Jan. 24, an impression will be gained that most of the pioneer work in respect of multi-point gas water heating was carried out by ourselves—Ewart & Son—whereas, he, Dr. Bernard Friedman, or so we understand, claims that such pioneer work was, in fact, carried out by his Company, Ascot Water Heaters, Ltd.

We are anxious neither to claim credit to which we are not entitled, nor to deny credit where it is due, but frankly both Dr. Bernard Friedman's objection and his statement in respect to his Company cause us very great surprise.

In respect of his contention that the pioneer work in building up the popularity of, and especially the market for, multi-point gas water heaters in this country was carried out by his Company, we find, on reference to the files at Somerset House, that his Company, Ascot Water Heaters, Ltd., only came into existence in 1933. Surely neither Dr. Bernard Friedman, nor anyone else, will deny that Ewart & Son were very well known at that date, and, in fact, for very many years before were manufacturing and selling multi-point gas water heaters in very large numbers both in this country and overseas.

How then does Dr. Bernard Friedman justify his suggestion that his Company, Ascot Water Heaters, Ltd., is responsible for the multi-point water heater when, in fact, multi-point water heaters were being manufactured and sold by Ewarts in this country in very large numbers for some 30 to 40 years before Ascot Water Heaters, Ltd., ever came into existence? Surely, Dr. Bernard Friedman is under a serious misapprehension.

Dr. Bernard Friedman has picked out four points from the article mentioned, which appear to have upset him particularly. None of these is claimed by us as a novelty, but they were just stated to be included in the standard heater as supplied by the makers.

As regards temperature selectors for which we, ourselves, have made no claim, we would like to mention that a water heater with an adjustable automatically controlled device for regulating the temperature of the hot water was patented as long ago as 1885, but was not then called a "temperature selector."

It is interesting to note that we have a certificate in respect of a "Lightning" geyser with a gas governor, awarded at the International Exhibition held at Chicago in 1893, the award being worded as follows:—

"A most excellent regulator for gas pressure, which maintains a constant flow at practically uniform pressure independently of extreme and sudden variation of pressures in the mains."

Yours, &c.,

EWART & SON, LTD.,
Established 1834.

Euston Road, N.W.
April 18, 1940.

Handling Coal from Storage

SIR,—The observations in the current issue of the "JOURNAL" relative to the storage of coal are of great interest to us.

For many years we have been debating this problem with gasworks managers, and have endeavoured to show that storage of coal can in many cases be a good deal less expensive than would appear at first sight.

The functions of the loading shovel have been explained in advertisements, and in personal contact, and it has been our privilege to be informed by several well-known gas engineers and managers that since the outbreak of hostilities they have been more than justified in installing the Chaseside loading shovel.

Many instances have been brought to our notice where some 200 tons of coal have been recovered from stock in eight hours at a cost which is extremely economical.

A great advantage of this type of equipment is that it is mobile, and therefore a good proportion of the fixed charges which would otherwise have been placed against storage equipment is eliminated. The cost of recovery of coal from stock by this means is reduced proportionately with the duties which can be assigned to the loading shovel. Among these are the handling of

all loose materials, uses as a portable crane, a shunter, and for towing A.R.P. pumps.

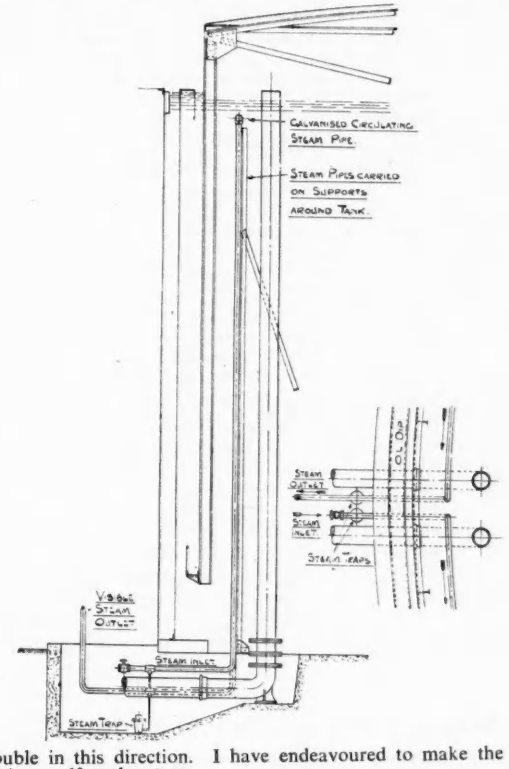
We should be happy to provide any gas-works manager or engineer with particulars of how this machine can be used to help solve the storage problem.

Yours, &c.,
A. E. TYRELL.

Chaseside Engineering Co., Ltd.
Enfield.
April 20, 1940.

Ice in Gasholder Tanks

SIR,—Having in mind the various letters and illustrations that have appeared in the "JOURNAL," with reference to this subject, I enclose an illustration showing my method of trying to avoid



trouble in this direction. I have endeavoured to make the illustrations self-explanatory.

In my view, if sufficient anti-freezers are provided and suitably spaced around the dip, having the sealed steam outlet always pointing at one direction, a slight movement of the water contained in the cup would be ensured. By this means, together with the interior circular steam pipe fixed adjacent to the shell, ice difficulties would be avoided.

This arrangement can only be fixed while the gasholder is in course of erection, unless, for some reason, it is necessary to empty the tank, which would permit a circular steam pipe being installed.

Yours, &c.,
April 11, 1940. J. WINSON SCOTT.

SIR,—I observe that a number of your correspondents are still undecided as to the manner in which water begins to freeze, although I explained this in detail in my last letter on April 10. My original statement that ice first forms on the upper surface of the water in a tank is correct, and in support of it I give the following extracts from two well-known text books dealing with the subject of Heat:

(1) "A Text Book of Physics," by J. Duncan and S. G. Starling, p. 339, 1920 Edition.

After describing Hope's experiment, the Authors state that

> ". . . . From this point onwards, the cooling below 4° C. of the water near the middle of the vessel results in an increase of volume, and consequently a decrease in density, which causes the colder water to rise to the top. This is indicated by the upper thermometer falling gradually to 0° C., *and ultimately a layer of ice is formed on the surface of the water.*"

(2) "Heat for Advanced Students," by Edwin Edser, p. 85, 1919 Edition.

After the description of Hope's experiment the Author states that

> ". . . . Soon after the lower thermometer has reached 4° C. the temperature indicated by the upper thermometer will commence to fall, and will continue to do so till 0° C. is reached, *and ice begins to form on the upper surface.* The temperature indicated by the lower thermometer remains during this period at 4° C."

These statements prove conclusively that ice forms first on the top surface of the water in a vessel.

Now with regard to the various methods which may be adopted in preventing ice formation inside the holder, it will be realized that engineers and others interested in this problem will have different opinions as to which system is the best. The methods eventually adopted for the prevention of ice in gasholders will obviously depend to a great extent upon the circumstances and facilities obtaining in any particular case. In countries where relatively severe winter weather conditions obtain over long periods every year, the apparatus used may be expected to differ in general from that used in this country, where very severe winter conditions are the exception rather than the rule.

Yours, &c.,
"Amherst," S. M. MILBOURNE.
New Church Road,
Wellington, Shropshire.
April 20, 1940.

SIR,—From my experience ice does definitely form on the surface of the tank water inside the holder to a greater or less degree according to the position of the holder and its exposure to cold winds.

During the prolonged cold spell in January we had a holder thrown out of commission due to ice damaging the inlet and outlet pipes. This occurred in spite of the fact that ice was kept clear from the tank water outside the holder by the usual anti-freezing methods. The holder functioned until it commenced to uncup, and immediately the inner lift came into operation the mishap occurred. This would point to the fact that tank steaming outside the holder kept the ice clear inside for a distance sufficient to clear the vertical stays in that lift; but immediately the next lift came into operation it made contact with the ice raft and trouble followed.

During the cold spell early in the year there were probably many holders functioning with ice inside on the surface of the tank water; but if the holder does not uncup all is well.

If we are to have these severe winters the question of ice formation on the surface of the water inside the holder is very serious, especially with spiral holders, and the subject calls for very thorough investigation. It would be interesting to know what is done in countries where very severe winter conditions prevail over long periods. Possibly they do not use spiral-guided holders.

Yours, &c.,
April 17, 1940. "CONCERNED."

SIR,—I have followed with interest the recent contributions on the important subject of ice formation in gasholder tanks. As the method I have adopted at Fleetwood appears to be unknown to your correspondents, they may be interested, particularly as the maintenance cost is much lower than the "standard" method using steam. Moreover, the amount of steam required by the standard method is often a serious matter where no standby boiler exists.

Briefly the method takes advantage of the slow rate at which liquid diffusion takes place and consists of introducing very hot water on to the surface of the tank or cups. This need be only introduced at one point. The speed at which it spreads round the surface and removes ice has to be seen to be believed.

During the severest weather of the recent winter I found that 200 to 250 gallons per hour were sufficient to deal with a fully exposed tank and spiral holder of half a million cu.ft. capacity.

Yours, &c.,
Fleetwood Gas Company, THOMAS E. PARRY.
Fleetwood, Lancs., Engineer and Manager.
April 16, 1940.

Eastern Counties Association

The Spring Meeting of the Eastern Counties Gas Engineers and Managers' Association will be held at Norwich on Thursday, May 23, under the Presidency of Mr. J. Kennington, Engineer and Manager of the Great Grimsby Gas Company. The Norwich Works of the British Gas Light Company will be open for inspection, and after the business meeting a Paper will be read by Mr. W. T. Hallam, of Bedford.

News of the Week

Volume Three of Arthur Coe's "Science and Practice of Gas Supply," has been presented to the city library by Mr. F. H. Goodwin, Engineer and Manager of the Salford Gas Department.

In Spite of the Absence of street lighting, which accounts for an average annual consumption of 2,573,000 cu.ft., last year's gas consumption figures at Cockermouth were only 200,000 cu.ft. down on those of the previous year.

The Directors of the Luton Gas Company are offering for sale by tender such an amount of 5% redeemable preference stock, redeemable at par on Jan. 1, 1955, as will with premiums realize the sum of £21,788 17s. 6d. The minimum price of issue is £103 per £100 of Stock.

Application is to be Made to the Board of Trade by the Redditch Gas Company for an Order under Section 1 of the Gas Undertakings Act, 1929, to authorize the Company to raise additional capital to an amount not exceeding £100,000 by the creation and issue of new ordinary and/or preference shares or stock.

Wartime Lighting Fittings have been attached to 20 lamps in West Parade, Lincoln, and the lamps are to remain alight for a sufficient period to enable the Street Lighting Sub-committee of the City Council to decide whether or not to recommend the conversion to the new system of all or part of the 2,000 gas street lamps in the city.

The Underpressure Engineering Co., Ltd., has removed from Burgess Hill to more suitable and commodious premises at Union Foundry, Mansfield, where it has all the facilities of an up-to-date foundry and machine shop, with over 30 years' experience of underpressure work. The London office is at Norfolk House, Norfolk Street, W.C.2.

A Successful Series of cookery demonstrations featuring "Wartime Cooking Economy" were held by the Llanelly Gas Light Company from April 8 to 12. Attendances were good, and great interest was shown in the various economical menus—prepared with the aid of the streamline "Newhome" cookers. The demonstrations were given by Miss E. D. Newberry, of Falk, Stadelmann & Co., Ltd.

An Extra General Meeting of the Internal Combustion Engine Group of the Institution of Mechanical Engineers will be held on Friday, April 26, at 6 p.m. at the Institution, Storey's Gate, St. James' Park, S.W.1, when a Paper entitled "Fuel Injection in Oil Engines in Relation to Combustion," will be read by Mr. G. W. A. Green. A further meeting of this Group will take place on Friday, May 3, at 6.30 p.m., when an informal discussion will be held on "Operating Experience with Gas Producers."

At a Meeting of the Institution of Chemical Engineers to be held on Tuesday, May 7, at 5.15 p.m., in the rooms of the Geological Society, Burlington House, Piccadilly, W.1, a Paper on the "Measurement of the Flow of Liquids and Gases" will be presented by Mr. E. Ower, B.Sc. Tea will be served at 4.45 p.m. Members of The Institution of Gas Engineers desiring to attend must obtain cards of introduction from either Mr. A. J. V. Underwood, or Mr. M. B. Donald, the Institution of Chemical Engineers, 56, Victoria Street, S.W.1.

Wartime Cookery Demonstrations were recently held by the Blackburn Corporation Gas Department in collaboration with the Parkinson Stove Company, Ltd. Lectures on menus comprising suitable nourishing and tasty dishes for wartime catering were given by Mrs. Feilden the first week, and Miss Dorothy Scott, of the Parkinson Stove Company the second week. The lectures were well attended, and keen interest was shown in the preparation and cooking of the specially selected menus, devised to assist housewives in catering successfully with restricted food supplies.

Agreement Has Now Been Reached between the Cambridge Corporation and the Cambridge University and Town Gas Light Company in respect of the payment which the Corporation will make to the Company, on account of the cessation of public lighting. The Corporation will pay to the Company the sum of £2,394 per annum, and provision has been made for a review of certain items at the end of 12 months. In so far as the negotiations between the Company and the Fulbourn Parish Council are concerned, the latter have agreed to pay the Company one-third of the pre-war annual cost of lighting, and in the case of the other areas where the lamps are owned by the lighting authorities, suitable arrangements have been made, whereby the Company will maintain the lamps.

The Nottingham Co-operative Society in their half-yearly report state that arrangements are being made to convert all their baking ovens to gas firing. Their latest new oven is a gas-fired one.

So Keen Were Housewives at wartime cookery demonstrations held recently by the Annan Gas Company, in collaboration with the Parkinson Stove Company, to obtain advice on the special menus devised for catering with restricted food supplies, that when the demonstrator, Miss Barbara Cobb, of the Parkinson Stove Company was unable to obtain vegetables from the usual source, housewives actually made contributions of a wide variety, which amply met requirements.

Lectures on Selected Menus devised to assist in catering with restricted food supplies, have been given to keen audiences in the areas served by the Runcorn & District Gas Company, and the Ormskirk District Gas Company, while demonstrations are continuing in the Northwich and Littleborough districts, and the areas supplied by the North Cheshire Gas Company. The arrangements were made by the United Kingdom Gas Corporation, Ltd., in collaboration with the Parkinson Stove Company.

Middlesbrough Town Council has confirmed the acceptance of the tender of Messrs. A. E. Hobbs (Contractors), Ltd., of Norton, Stockton-on-Tees, at £6,488, for the laying of a 24-in. main from Messrs. Dorman Long's works at Grangetown to Middlesbrough—a distance of four miles. The main will carry coke oven gas. The Council was originally recommended to accept the tender of Messrs. Jeavons & Co., Tipton, but this was rejected on the grounds that there were lower tenders. Afterwards the contract was let to Mr. T. Coates, of Bury, who refused it on account of insufficiency of local labour to carry out the work.

Approval Has Been Given by the Stockport Town Council to the decision of the Gas Committee to place the keeping of the accounts of the Department in the hands of the Borough Treasurer, but the recommendation that a Secretary be appointed to assist the Engineer and Manager was referred back for further consideration. The Gas Committee recommended the retention of the post of Secretary to assist the Engineer and Manager on the commercial side, the Borough Treasurer to be responsible for the preparation and issue of consumers' accounts, the keeping of the personal accounts with all debtors of the undertaking, and records of all sales. As soon as could be conveniently arranged, it was proposed that one account should be rendered to consumers for both gas and electricity.

Association of Tar Distillers

The "oldest trade association in the country," as it proudly claims, substituted a Luncheon this year owing to war conditions for its more usual Annual Dinner. In spite of all difficulties, the gathering at the Savoy on April 16 was just as happy a function as the dinner always has been, and was excellently attended by members and guests from all parts.

A breezy speech by Lt.-Comdr. Colin Buist, Vice-President of the Association, proposing the health of the guests, emphasized in graphic manner the special tasks of the tar industry in wartime, and the reply of Mr. Robert Bernays, M.P., Parliamentary Secretary to the Ministry of Transport, endorsed the confidence of the Government that the Industry will be able to carry them out. The toast of the Association was given by Mr. R. Duncalfe, Chairman of the Association of British Chemical Manufacturers. In his reply, the President, Mr. Stanley Robinson, affirmed the determination of the members to devote their energies exclusively to the winning of the war. It was true that the struggle, from its outset, had altered to a large extent the direction of these activities, but all they asked was a clear indication from the Government of what was wanted. They could be relied upon to do the rest.

The toast of the Staff, with special mention of Mr. Murdin Drake, was heartily received, and the proceedings terminated with a presentation by the President, on behalf of one hundred per cent. of the members, of a wedding gift to the Secretary, Mr. J. Davidson Pratt, O.B.E. As Mr. Duncalfe remarked, it is surprising that he has had time, with his very many activities which have even increased since the war, to give thought to matrimony. It will be remembered that Mr. Pratt was recently appointed Chairman of one of the Government Committees which are investigating various aspects of the possibility in wartime of replacing imported oil by home products.

Distribution of Steel Supplies

Legal effect is given to the scheme for the distribution of steel supplies, to which reference was made in the "JOURNAL" of March 27 (page 675) by the Ministry of Supply's new Control of Iron and Steel (No. 8) Order, 1940, which came into force on April 8, superseding the No. 6 Order made on Jan. 29. The steel products covered by the scheme can be acquired by the authorized quotation in all orders of a symbol, contract or reference number and delivery period. The Order itself contains a number of alterations in wording, but these have been introduced mainly to bring the language of the Order in accord with the standard form now used by the Ministry of Supply.

Materials and products imported from abroad are free from Iron and Steel Control licence because they are covered by the necessity of obtaining an Import Licence, and material to be delivered abroad or aboard ship for export is exempt from maximum price restrictions. The Ministry of Supply is exempt from the provisions in regard to maximum price, but the Departments of the Ministry are still subject to the various provisions in regard to licensing, exemption from licence, obligation to quote symbol, contract or reference number and delivery period, in the same manner as other Government Departments.

Although the Order came into force on April 8, the operation of the paragraph under which a symbol, contract or reference number, and delivery period are to be used for all new orders for steel products is postponed until April 29. In respect of old orders placed before April 8, the application of the paragraph is further postponed until May 31. The position therefore is that by April 29 all new orders must be covered by a symbol, contract or reference number, and delivery period, and all old orders must be given this authority by May 31. This latitude has been given only to enable the carrying out of orders where the necessary references cannot be obtained immediately, and all orders must be so authorized as early as possible.

Increases in maximum prices have been fixed for certain more highly finished products, notably crown iron, colliery arches and accessories, galvanized sheets, tubes and pipes, certain types of wire and wire products, steel castings, and railway coil and laminated springs.

Under the Direction No. 1 issued with the Order, iron castings (except tubes, pipes and pipe fittings) which have been subjected to any process other than moulding, fettling, annealing or painting, are exempted from licence whether for use in or out of the United Kingdom. After defining the requirements of the steel distribution scheme, the Direction makes it clear that a stockholding merchant may only acquire material without licence where the goods are delivered directly from his supplier to his customer. All licences previously issued to stockholding merchants for stock are revoked, and these should be returned to the Iron and Steel Control. Licences and exemption from licences of materials not covered by the distribution scheme continue substantially on the existing basis.

Forthcoming Engagements

April.

25.—Institute of Fuel.—Meeting in Connaught Rooms, Great Queen Street, W.C.2. Paper by J. N. Dundas Heenan on "Steam Plant Design."

27.—Manchester and District Juniors.—Meeting at Stretford. Papers by J. C. Hogg on "Carbonizing of Stock Coal," and by H. Q. Marris on "Sales of Appliances in Wartime."

27.—Scottish Juniors.—Joint Meeting at Glasgow Lighting Department, 20, Trongate, 3 p.m. Address by F. S. Hale.

May

3.—North of England Association.—Annual Meeting, County Hotel, Newcastle, 2 p.m. Luncheon, 12.45 p.m.

6.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.

7.—N.G.C.—Central Executive Board, 2.30 p.m.

7.—I.G.E.—Council, 10 a.m.

8.—I.G.E.—Library Committee, 11 a.m.

9.—Federation of Gas Employers.—Annual Meeting of Members in Scotland, North British Station Hotel, Edinburgh, 11.30 a.m.

9.—N.G.C.—Annual Meeting of Members in Scotland, North British Station Hotel, Edinburgh, 2.30 p.m.

18.—Scottish Western Juniors.—Address by N. G. MacGregor, on "Education."

22.—Southern Association.—Eastern District Meeting, Gas Industry House, 2.30 p.m.

23.—Eastern Counties Association.—Spring Meeting at Norwich. Paper by W. T. Hallam (Bedford) and Works visit.

June.

4 & 5.—I.G.E.—77th Annual General Meeting in London.

5.—N.G.C.—Annual General Meeting, May Fair Hotel, Berkeley Street, W.1, 2.30 p.m.

Institution of Gas Engineers

As a result of joint representations by The Institution of Gas Engineers and other Chartered Engineering Bodies, the Minister of Labour and National Service has notified the Secretary of the Institution that it has been decided to make the following new entry in the Schedule of Reserved Occupations: Student engineering apprentice or learner, reserved at and above the age of 18 years.

This entry relates only to a man employed in industry or under articles to a professional engineer who produces a certificate from a university or technical institution or from a professional Institution of Engineers to show that he is within two years of the satisfactory completion of a course of study with a view to offering himself for the first time for:

(i) An Engineering Degree;
(ii) An Engineering Higher National Certificate;
(iii) An Associate Membership of the Institution of Civil, Mechanical, or Electrical Engineers, or the Associate Fellowship of the Royal Aeronautical Society; or
(iv) An examination of similar standing to that of an Engineering Degree.

The definition is intended to cover under paragraph (iv) the case of other professional institutions of engineers not mentioned specifically under paragraph (iii).

From paragraph (iv) above and the subsequent amplification of it, it will be noted that those applying to come within the Schedule of Reserved Occupations should be Students of the Institution and within two years of completing their final course of study.

Applications for Forms for election to Studentship and any further information connected therewith, should be made to the Secretary of The Institution of Gas Engineers, 1, Grosvenor Place, London, S.W.1.

"A Kitchen Goes to War"

According to Mrs. Chamberlain, the Prime Minister enjoys a homely fish and leek pie, and her recipe certainly makes it sound delicious. It is given among 150 other recipes, which are special favourites with famous people, in a wartime cookery book "A Kitchen Goes to War," to be published by the British Commercial Gas Association and John Miles & Co., on April 26, in support of the National Food Campaign. The preface makes it clear that the Gas Industry is responsible for collecting the material, and the book carries a chart showing the heat controls of gas cookers, while references to gas are scattered throughout the recipes.

The production is thus unmistakably linked with gas, and yet quite unobtrusively. The book costs only 6d. and any profit that may be made will be handed over to wartime charities. It may be bought or ordered from booksellers and newsagents throughout the country, but in view of its undoubted publicity value to the Industry the B.C.G.A. have arranged to supply copies to members at 5s. 6d. per dozen copies, or 45s. per 100 copies. These prices include the charity royalty and a few copies of a display card. The booklet is attractively produced and the varied tastes of famous people and the ways in which they are coping with rationing are bound to be of interest to the public.

The B.C.G.A. make a number of suggestions as to how gas undertakings may benefit to the full from the opportunities provided by the publication of the book, and Selfridge's of London have been among the first to realize its value. They are devoting a large Oxford Street window to a display of "A Kitchen Goes to War," the central feature of which will be a modern gas cooker. Surely an almost unprecedented compliment to a 6d. book.

Wales and Monmouthshire Association

The 35th Annual Meeting of the Wales and Monmouthshire Association of Gas Engineers and Managers will be held at Porthcawl on Thursday, May 23, under the Presidency of Mr. J. Prosser Jones, of Cardiff.

North of England Gas Managers' Association

The Annual General Meeting of the Association will be held on Friday, May 3, at 2 p.m. prompt, at the County Hotel, Newcastle. The ordinary business will be transacted and Mr. T. Law will give his Presidential Address. Prior to the meeting Luncheon will be taken at the County Hotel, at 12.45 p.m.

NORTH BRITISH ASSOCIATION LUNCHEON

We give below a report of the luncheon speeches which followed the Spring General Meeting of the Association held in Glasgow on April 5 and reported in previous issues. The President (Mr. H. A. Aitken) presided.

After the loyal toast Councillor E. ROSSLYN MITCHELL, proposing "The Gas Industry," said he had received instructions to be brief, as gas managers did not like long speeches. He had been asked to finish up with a word of encouragement to "this perpetually moribund industry." His association with the Gas Industry was 31 years old, for it was 31 years since he had entered Glasgow Town Council, though he did not consider himself an antique. He had joined the Council as a young man. From the beginning of his association with the Industry he found several things in it. First, there was a warm comradeship among gas managers and no rivalry of the kind that often existed in other professions. Secondly, it was an hereditary Industry and he found men in it whose fathers and grandfathers had also been gas managers. Thirdly, it was an Industry that was always on the point of extinction—but, like Charles II, it took an unconscionable time to die. It was said to be on its last legs because the coal fields were on the point of exhaustion and then, when they were assured of coal for thousands of years to come, because gas would be supplanted by electricity. The Industry, according to a convention, had seen its best days, and all they could do was to be respectful while they accompanied the procession to the crematorium! The real story, however, was very different. In their profession they had the singular advantage of being associated with a business which dealt with matters both commercial and scientific.

A Great Part to Play

Dealing with the present situation, Mr. Rosslyn Mitchell said that the Industry had a "terrific" part to play in the present war conditions. There were young men there who might be hearing these days of what happened in the Industry during the last war. The production of gas in those days was a matter of complete indifference compared with the turning out of by-products, the price of which soared enormously. It was worth while in those days blowing the gas into the air in order to retain the by-products and sell the coke. They were not likely, however, thanks to the activities of Treasury officials, to have such an Eldorado during the present war. The Industry was not likely to have free scope to sell in open markets and at high prices, as their predecessors did twenty years ago. At the same time, there would be a constant and ever-increasing demand for their by-products and coke and they would be at least relieved of any anxiety regarding their disposal. Nor had they anything to fear from electricity. Their skill and energy, plus the developments in the Industry, made them secure. Gas and electricity were not rivals but both together could prosper and contribute to a higher standard of living for the people. A young man entered public life full of ideas of reform. These were carried out and as he grew older he grew depressed and opposed the reforms of younger men. Such a man should look back and think of the situation before his reforms became effective. So was it with the Gas Industry. They should look back and consider the position of the Gas Industry to-day compared with what it once was. They should be glad that they had provided warmth and light in places that formerly were frigid and dark. He coupled the toast with the name of Mr. George Dixon—the "high heid yin of the high heid yins."

A Message of Goodwill

Mr. DIXON, replying, said that in England they were always hearing from the leaders of their Gas Industry there about the wonders of their native land North of the Tweed. Their Industry was all right both technically and socially. He brought them a message of congratulation and goodwill. Mr. Rosslyn Mitchell had been generous in his appreciation of the Industry, and all he could say was "Thank you." It was true that during the last war they were able to contribute very materially to those things required for the successful prosecution of the campaign. But they claimed no credit for that. They were in an Industry which by its very nature provided not only gas but also those other things that were necessary for the nation. It was their good fortune to be again in a position to make a handsome contribution. They had to make a greater effort than before to see there was no waste.

Dealing with the Institution, Mr. Dixon said there was great activity in research and technical work at the present time. They were in constant touch with the Government and had its confidence. The Government was bringing certain problems to them and the Institution was doing its best to solve them.

During the last two days, said Mr. Dixon, they had seen two sides of their Industry. One was the social side. They did not get together because of any feeling that they had a monopoly in the fuel industry. They knew they had a sister in it, and the little competition that had come from electricity was good for them. They had been led to a definite understanding as to the field of each industry. There was no misunderstanding. Gas would supply heat. There were other things of equal importance for their friend electricity to do.

Mr. Dixon said they were a little concerned about the position of their raw material. Too much should not be said at the present time when things are difficult. The national coal resources should be used to bring the best benefit to mankind. They had chosen their plant and methods and markets to do the best they could for those they served and it was wrong that the coal owners should not give them credit for knowing their job but should try to force on them any kind of coal they wished. He was still hopeful that goodwill and co-operation would enable them to meet their coal friends round the table and enable them to get back to sane and reasonable marketing for the benefit of all.

Mr. DAVID FULTON (Helensburgh) proposed the toast of "The Chairman," and Mr. AITKEN, replying, acknowledged his debt to Messrs. Kellock and Sturrock for their help.

Women's Gas Council Organize Demonstrators' Conference

On Saturday, April 13, the Women's Gas Council held a one-day Conference for Gas Cookery Demonstrators to discuss their work in connexion with the Food Education Campaign.

Miss G. S. Summers, H.M.I. Board of Education, gave the delegates a most inspiring address on "Food Education in Wartime." Miss Summers pointed out that the war offered us a golden opportunity to show the housewife the value of the protective foods, for these were the foods of the dairy and the garden, which we were being asked to use to save shipping. She urged the use of local dishes and gave helpful suggestions for planning series of demonstrations.

Miss M. P. E. Pearson, Dietitian to the Gas Light and Coke Company's Home Service Department, spoke on "Food and Fitness in Wartime." Among other valuable points, the speaker dealt with substitutes for rationed and scarce foods and with the protective foods, giving a list of portions to supply sufficient protein for the main meal of the day.

In the afternoon there was an open session, when delegates discussed their work. Miss E. Willans, M.B.E., Chairman of the London and Home Counties Demonstrators' Circle, was Chairman of the Conference. Eighty-five delegates attended from all over the country.

Gas Undertakings' Results

Bombay

The Directors of the Bombay Gas Company, Ltd., in their report for 1939, state that the Revenue Account shows a profit for the year of £32,734, while the balance brought forward from the previous year amounts to £45,645. After the payment of a dividend making 8% for the year, there will remain £48,779 to be carried forward. For the preceding year the profit was £24,329, but there was also a profit on exchange of £6,178. The dividend was the same as on the present occasion. The quantity of gas sold during the past year was 617,352,600 cu.ft., which compares with 595,766,000 cu.ft. in 1938.

Cape Town

In their report for the year 1939 the Directors of the Cape Town and District Gas Light and Coke Company, Ltd., state that the demand for gas at competitive rates for industrial uses continues to grow, although the unsettled conditions in the last quarter of the year affected business adversely, and the total quantity of gas sold for the twelve months was lower by 2.45%. Revenue from sale of residuals, however, was well maintained. The price of coal again increased, but expenditure on all other accounts was lower, and the balance of revenue account improved by £1,700 to £17,863, which, with the sum brought in, makes a total of £19,778. After meeting debenture charges and making a transfer to plant (Renewals) Reserve, there remains a sum of £2,241 to be carried forward. The cost of renewal work carried out has been charged against the reserve provided for this purpose; obsolete appliances have been scrapped, and their book value written off; and pensions paid during the year have been charged against Pensions Fund.

FEATURES OF THE PERFORMANCE OF GAS WATER HEATERS

A Paper to the London and Southern District Junior Gas Association on April 5.

by

J. Cooper, B.Sc.,

Gas Light and Coke Company

The modern non-storage (or "instantaneous") gas water heater, with which this Paper will mainly deal, is a highly complicated piece of mechanism, and its design, manufacture, testing, and assessment call for some skill and experience. It is the object of this Paper to discuss several features, desirable and otherwise, of these heaters, and to show how by the correct interpretation of the results of well-conceived (and well-executed) laboratory tests, these features can be estimated, and where necessary corrected, before the heaters are put on the market.

I have not aimed at making the Paper comprehensive, partly in the interests of brevity and partly because I wish to avoid unnecessary repetition of matters dealt with in previous Papers to the Association. Nor is the treatment of the features I have selected intended to be exhaustive.

Baffler Performance

Bafflers to an increasing extent now form integral parts of water heaters. A full treatment of this subject was given in a Paper presented to this Association by Messrs. Legg & Noble in 1937, and subsequently the British Standard Specification (No. 766-1938) for baffler performance was published. Our own tests are based on this Specification, the requirements of which, although searching, can be fulfilled if the design of the baffler itself, together with that of the appliance to which it is fitted, is treated with care. They consist essentially in using the change of CO_2 content of the primary flue gases, under varying conditions of up and down draught, as a measure of the degree to which the baffler succeeds in achieving that isolation of the appliance from secondary flue effects which it is its main purpose to secure.

In the Paper referred to it was stressed that the performance of a baffler can only be discussed in relation to a specified appliance. Further work has now been done on the effect of the actual shape of the appliance as affecting baffler performance, and some interesting information has been obtained. For example, it has been found that under down-draught cylindrical appliances in particular, when they include incorrectly designed tops, are prone to the following trouble. The stream from the baffler hugs the side of the appliance, and a region of low pressure is established about the burner, and bad combustion results. The fault can be cured by alteration in the shape of the top and, in some cases, the inclusion of a lip on its periphery; the stream is diverted from the side of the appliance, and the supply of air to the burner is no longer disturbed.

Thermal Efficiency

While the chief function of the baffler is to ensure safety, it also serves as a control (though not the only one) of the amount of air flowing through an appliance and can thus be used to ensure optimum thermal efficiency during normal operation of the appliance, if due attention is paid to the other factors affecting the value of this quantity. It is necessary to consider rather more fully than usual the precise significance of "thermal efficiency" if we are to arrive at a correct evaluation of the merits of a heater.

The conventional method of expressing the output of an instantaneous water heater is in "gallons per minute raised 40° F." or other temperature. The thermal efficiency (based on the gross calorific value) is determined at this temperature rise, and the heat output calculated, the appliance being (thermally) in equilibrium.

The actual bench efficiency is not unimportant and as a general rule should be between 75% and 80% at 40° F. water temperature rise, since if the higher value is exceeded condensation troubles, both in the appliance and in the flue, cannot easily be avoided, and if the lower value is not achieved running costs approach unnecessarily high levels. Furthermore, as flue gas temperatures become excessively high (> 700° F.), fire hazard is increased, and the choice of flue materials becomes limited.

At the same time, to concentrate solely on the bench efficiency to the exclusion of overall efficiency may easily lead to the incorrect assessment of the relative performance of two appliances for certain purposes.

Since in practice the appliance (or parts of it) must be heated before hot water can be drawn, the practical efficiency of a particular heater is therefore always lower than the bench efficiency at the same temperature rise, decreasing as the volume of the draw-off is reduced, since the smaller the draw-off the greater the relative effect of the thermal capacity of the heater. As an example, a certain heater with a bench efficiency of 80% gave a practical efficiency of only 10%, with a ½-pint draw-off.

This effect of thermal capacity is of such importance that a fuller discussion is required. It is clear that each time the heater is used the bulk of it is raised in temperature. This is not an instantaneous process, and some of the heat involved does not pass into the water until the heater is shut down. Thus the efficiency is reduced, and if the thermal capacity is too high, "after warming" of the water occurs, sometimes with undesirable results.

It can be seen that if the thermal capacity of the heating body on a particular heater is reduced without change of bench efficiency, then the "practical" efficiency for equivalent draw-offs will be increased.

This change can be effected by:

(a) Alterations in design, such as making the unit more compact;
(b) Changing the material; or
(c) Leaving the material unchanged and lightening its gauge.

Reduction in the weight of the body, however, can and probably will, tend to a lessening of life and lower mechanical strength, so that unless the body originally contained unnecessary metal, which is unlikely, such an alteration should be proceeded with carefully.

Thus one of the problems in designing a heater to give good all-round performance over a long period is to balance between the two effects.

It is of interest that the use of aluminium sprayed steel in place of copper has been tried in Germany, but the thermal capacity of such a heating unit is some 10% higher than that of a similar copper unit of the same gauge and suitable for the same heat input. Thus assuming equal "bench" efficiencies for units in the two materials, the "practical" efficiency of the steel unit would always be lower than that of the copper one at the same draw-off, and after-heating would be increased.

Certain open type heaters, whatever one's views on their merits from some points of view, are a good example of how minimum thermal capacity leads to maximum practical efficiency, and for this reason our nearest approach to a truly instantaneous heater.

The performance of boiling water appliances which are becoming increasingly popular is of interest, as in some designs even bench efficiencies are regrettably low. This results from the formation of steam, which is allowed to escape, its heat content, therefore, being lost. Two samples of this type of appliance recently examined gave bench efficiencies of the order of 40%. This figure could admittedly be improved by careful adjustment of the control, but it is unlikely that such adjustment would be made by the consumer, and therefore the appliances could not be considered wholly satisfactory.

Storage heaters are not subject to the falling off of efficiency with decreasing amount of draw-off to the same extent as

those of the non-storage type, as they are not heated from cold each time hot water is drawn. As is known, however, they are subject to other losses, which may or may not be of greater importance according to local circumstances, method of use, &c. Other losses, such as those due to hot water being left in pipes, not being peculiar to gas, and depending on the system rather than the appliance, will not be discussed.

Automatic Valves

The purpose of these devices, which are of divers designs, is to prevent the gas being lighted except when a certain amount of water flow is exceeded. In general, modern valves fulfil this function satisfactorily, but it must be admitted that the performance of some types might well be improved. A full discussion is impossible in the scope of this Paper, but I should like briefly to touch on one or two features and on the method of test employed in relation to district performance.

The valves must be positive in closing—*i.e.*, the closing force must be high—so that extra resistances, due to such things as wear of the spindle and/or guide, or partial failure of the lubricant can be overcome. In general, this means that a large opening force is required; hence there is a tendency to employ relatively large diaphragms operated by pressure difference—in some cases on the venturi principle.

The maximum water temperature rise, which on a given heater is determined by the minimum flow at which the valve operates, is occasionally the cause of difficulties to district staff, following complaints by the consumer of inability to obtain hot water, particularly in the winter. To some extent these difficulties are unavoidable, as will be clear from the following considerations.

In London, the seasonal variation in main water temperature is (approximately) from 40° F. to 70° F., and in determining what rise shall be allowed, there must be a compromise between the desire to give hot water in winter, and the prevention of scale deposition which would result from overheating in summer. On soft waters, of course, the latter consideration does not arise, but other effects, such as general overheating, extra strain, may reduce the life of the appliance, if the temperature rise is high.

Our general requirement is that the maximum temperature rise shall be about 100° F., but exceptions are occasionally permitted, such as certain coil type heaters which are not so susceptible to the effects of overheating as are those with sheet-metal fins. Due to frictional forces, less force is required to keep a valve open than to open it. Thus the maximum temperature rise is obtained with a closing valve. This means that in practice the hottest water is obtained by opening the tap until the gas is fully on and then closing it slightly.

It is found that heaters giving the maximum temperature rise of 100° F. are the cause of relatively few complaints due to lack of hot water in winter, unless the complication of water pressure fluctuations is present. Under these conditions, the hot water temperature may become inadequate because of increased pressure, leading to increased flow, or because of decreased pressure causing the valve to close, thus shutting off the gas.

The method of test is simple, and consists in progressively increasing and decreasing the inlet water pressure, which is indicated on a mercury gauge attached to the heater, and taking readings of water rate, gas rate, and inlet and outlet water temperatures. For convenience a valve curve is drawn, which includes plots of water flow, gas rate and water temperature rise, against inlet water pressure, or in some cases pressure drop across the heater.

When a water governor is included in the heater, its performance is automatically obtained at the same time as that of the automatic valve, to which it is generally linked.

It is important that the valve should operate at such a head as is generally available from the tank supply in the common design of house. There is little difficulty in arranging for this in itself, but it is less easy to combine the low opening heads required with a strong closing force. A balance must be struck between the two, and real success can only be obtained by experience coupled with care in design and manufacture.

Gas and Water Governors

The desirability of fitting gas governors wherever possible is well understood. Therefore my remarks will be confined to water governors.

The unsatisfactory performance of non-storage heaters due to fluctuating water pressures has already been referred to, and the causes explained. A good tank supply is in effect governed, in so far as the inlet pressure to the appliance is steady. Where, however, such a supply is inadequate as, for example, in some blocks of flats, ffuctuations in pressure do occur.

When the heater is connected to the mains supply, wide variations in pressure may (and often do) occur, increasing the need for adjustment of taps by the consumer. To overcome this defect, heaters are now on the market which are specially designed for mains fixing, and have water governors as integral parts. These governors prevent serious fluctuations in flow from the heater, provided there is adequate inlet pressure available and thus obviate the need for tap adjustment. They are generally of the " volume " type and thus require no adjustment by the fitter. To compensate for seasonal variations in water temperature, a variable by-pass, adjustable by the consumer, is included in some models.

The testing of these fittings consists in measuring water flow and temperature rise at heads indicated by a pressure gauge connected to the appliance. The measurements are made at the different settings of the variable control, and thus the limits of operation of the governor are obtained. Independent governors of the variable loading pressure type are also available and are valuable for use either where ungoverned heaters already fitted on the main are giving bad service, or as part of new installations.

Ultimately, steady water pressures are the only remedy for one of the main defects in performance of the modern instantaneous heater, and the water governor is therefore a very desirable fitting, although as has been pointed out, its inclusion on all such heaters is not necessary.

Life Tests

We have so far discussed some of the more important features of appliances and the test methods employed in the laboratory to ensure satisfactory district performance. All such tests suffer from a limitation in that they do not show up those weaknesses which are obvious only after a time. Hence, there is need for a test or tests in which usage can be accelerated. Such a test, known as the life test, now constitutes part of the normal routine examination of non-storage heaters at Watson House, and is in many ways the most important test that is performed.

Storage heaters are not generally tested in this way, as usage cannot be accelerated to the same extent as can that of the non-storage type. In some cases, however, a modified form of test has been done on heaters of particular interest.

Distinction must be made between rapid and long-period corrosion, as only the former can be accelerated by the life test. For example, some samples of an automatic valve which worked successfully on life test have failed after long district use because of slow corrosion of the spindle by the lubricant employed.

The results are expressed in " Equivalent Days," one such day representing half-an-hour's usage.

This unit was fixed empirically as representing possible usage in domestic installations; but in future work the actual therms consumed during the test may be taken as the criterion.

What the Test Shows

Acceleration of usage occurs mainly in the heating body, or interior of the appliance, but other parts, as will be seen, are also affected.

The rate of corrosion and blockage of flueways can be determined during the test, and the results are of extreme importance, as unless maintenance is performed before the blockage becomes serious, bad combustion, sooting, and in the extreme case, burning-out, will result.

From a knowledge of the results of life tests on heaters of known district performance, the life test results on new appliances can be used in estimating the amount of maintenance they will require in practice.

The collection of corrosion deposits is also observed, and it is important to determine if it does, in fact, collect at vital points such as governor breathing holes, valve spindles, or burners, and, if necessary, to suggest alterations in design.

In the search for a material which will prove, if not entirely satisfactory, at least a good deal more effective than those at

present employed in resisting corrosive attack by products, the test has been used extensively.

Soundness of design and construction of heating bodies can be investigated, and such important points as the following, which must be corrected if performance is to be satisfactory, have been noted during the work that has been done.

(i) **Oxidation and Buckling of Fins,** caused by overheating of the metal, have been observed in some heaters. One case of serious buckling was found to have resulted from the use of a corrosion resistant alloy, without alteration in the design of the finbox. As the thermal conductivity of the alloy was only 1/14th that of the copper previously employed, fin temperatures naturally increased, leading to rapid failure on the life test, although the weakness had not been shown up during the simple routine tests.

Again, if the rate of heat transfer per unit area of fin is excessive, the temperature gradient across the fin becomes unduly high and the hottest parts of the fins are quickly destroyed.

While from the point of view of adequacy of fin area in relation to the required rate of heat transmission, heaters have been of satisfactory design, the life test has shown that in some instances the shape of the fins and/or their disposition relative to the water-cooled surface has been such that overheating has occurred, and in others persistent condensation over certain parts.

(2) **Combustion Chamber.**—The common form of non-storage finned heater includes a combustion chamber with water-cooled wall. The effectiveness of the cooling can be observed in the life test as if the cooling coil makes inadequate contact, the wall rapidly shows signs of overheating. Where cooling is excessive, condensation occurs, and at the points where it re-evaporates centres of corrosion are formed.

(3) **Joints** which have been incorrectly made or wrongly positioned fail when subjected to the repeated heating and cooling such as occurs during the test.

As an example, a certain heater developed a water leak during life test. This was thought to be due to one of those errors in manufacture which occasionally occur. The makers were informed, and they submitted a further sample which, however, showed the same fault. The heater was sectioned, and it was found that a hidden soldered joint was made just below the fins. At this point the rate of heat transfer was sufficiently high to cause the solder to melt, and it was suggested that the joint should be lowered another $\frac{1}{4}$ in. This was done, and the life test showed that no further leakage occurred.

Later we learned from the manufacturers that heaters of the original design had, in fact, developed leaks on the district, but that the heater in its final form was satisfactory in this respect. It will be clear that had such a test been done earlier by the makers themselves, the defect would have been observed before full production was commenced.

(4) **Automatic Valves.**—Regularity of operation can be observed and spindles can be examined for wear which may have been caused by the use of an unsuitable material or by bad workmanship. Distortion of the diaphragm, which, although not of prime importance, is to be avoided, can be observed. The test can also be used as a guide in the examination of alternative types of rubber for use in the manufacture of this component, although a full forecast of behaviour cannot be made.

What the Test Does Not Show

Automatic Valves.—The life of the diaphragm cannot be estimated as any slow change in nature of the rubber is not accelerated.

External Finishes cannot be adequately judged in quality, but the test does quite certainly assist in the separation of the wheat from the chaff, and to this extent prevents the use of entirely unsuitable materials.

Thermo Cut-off.—The depreciation in the quality of a good thermo cut-off is not shown by the test, but the really bad strip can be detected quickly, so that if during the test the bi-metal is trouble free it is reasonable to say that its district performance will be satisfactory, although the degree of its excellence cannot be forecast.

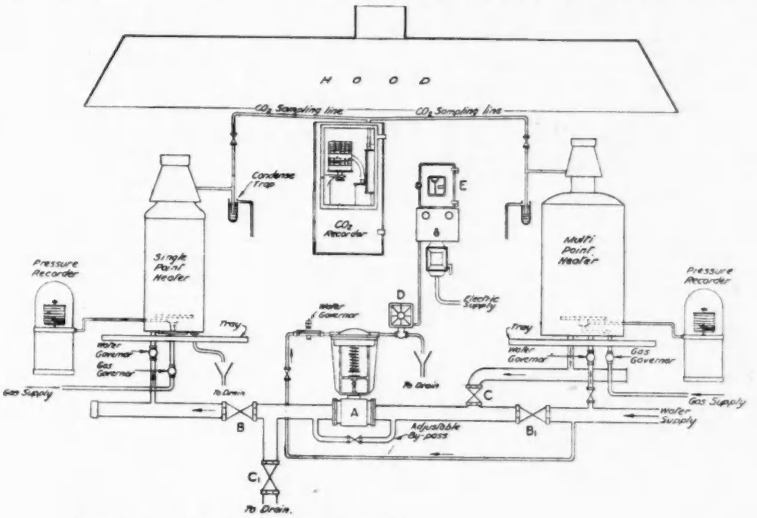
A. Drayton Pressure-Operated Valve

D. Satchwell Electric Oil Valve

E. Venner Time Switch

Single-Point Heaters—
Open Valves B & B_1
Close ,, C & C_1

Multi-Point Heaters—
Open Valves C & C_1
Close ,, B & B_1



Water Heater Test Bench at Watson House

DISCUSSION

Mr. **T. G. Noble** (Gas Light and Coke Company), opening the discussion, observed that two main points emerged from the Paper. The first was that laboratory tests could actually go a very long way—though not the whole way—in ensuring satisfactory results over an extended period. Their work in the testing laboratories was sometimes accused of being remote from reality; but they endeavoured to make the tests of the greatest practical value in giving information regarding the behaviour of appliances on the district. They always tried to link laboratory experiments with the district in every possible way. He felt that they had succeeded in no small measure—but not only as a result of their own efforts in the laboratory—and Mr. Noble said he would like to take this opportunity of thanking the many people who had collaborated in defining the tests and reporting the results among their own district staff, as well as the manufacturers who had listened to their criticisms and modified their appliances many times in an endeavour to meet what they called, the "Watson House requirements," to the mutual advantage of both sides. The second point that emerged from Mr. Cooper's Paper was that in the life test they and the manufacturers had a very powerful weapon for attacking problems relating to the design and performance of instantaneous gas water heaters. If a heater was used for short periods at a time each day it was easier to accelerate its life than was possible with a storage appliance. Mr. Cooper had shown the importance of the life test, and it really was of very great value in practice, although it was still capable of improvement.

A further point which arose from the Paper, continued Mr. Noble, was the question of on what lines future research on gas water heaters was to proceed. But that was too large a subject to deal with here. The first most urgent need, as he saw it, was for them to find materials and finishes for instantaneous gas water heaters which would overcome the corrosion problem and enable them to give better service with reduced maintenance. In this search the life test could play a very valuable part; but it must be linked up with other tests on materials and certainly with changes in the design of the appliances themselves. He was quite convinced that to ignore materials and finishes was to invite failure. Work on corrosion must, in fact, run concurrently with work on heat transfer and temperature distribution in appliances. The less done on this subject the more would they be working in the dark and the more time they would be wasting in testing materials which they should know in advance would prove unsuitable.

He did not know to what extent they would be able to carry on work on these constructive lines during the present conditions. The opportunity and the personnel would become more and more restricted; but they could progress even while the war was going on, and in some ways it offered opportunities for getting down to the task of planning for the future without having to pay so much attention to everyday business which had taken up so much time in the past. Mr. Noble therefore urged those concerned with the future of gas water heating to seize every opportunity of analysing the fundamental pre-requisites for real progress and then set about putting those ideas into practice—preparing for the future to which they all looked forward. Mr. Cooper's Paper came as a timely reminder of some important points relating to the design and performance of instantaneous gas water heaters and a very useful summary of the methods of testing and assessing the merits of water heaters for the future.

Mr. **A. B. Densham** asked why water governors were not used to a greater extent.

Mr. **Cooper** replied that this was in the lap of the manufacturers. They knew they were necessary, just as the Industry had always considered them necessary; but it was only recently that they had appeared. But those that had appeared were good and did not seem to have to go through the "teething" troubles that many other automatic controls had to go through. From this point of view, perhaps, it was better that there should have been this delay.

Use of the Pilot

Mr. **F. Holland** (North Middlesex) referred to troubles experienced last winter due to the freezing of the valve. His Company had advised consumers to keep the pilot burning night and day—and this had prevented freezing. He wondered, however, whether the continuous burning of the pilot tended to "tire" the bi-metal strip.

Mr. **Cooper** replied that a well-designed bi-metal thermo cut-off should stand up to continuous heating. It was intended to do so. To give proper automatic service the pilot must obviously be kept burning all the time. In the case of sink heaters, however, which were only used at odd times, the pilot could well be turned off by the consumer. But with a multi-point heater they could not give automatic service if the consumer had to light the pilot and wait for the bi-metal strip to warm up every time the heater was used. They had experienced many examples of failure of the bi-metal strip as a result of not being heat-treated after bending. The makers stated that the strip must, in fact, receive its heat treatment after it had reached its final form. In many cases, however, the heat treatment was applied before bending. Even a well treated strip, unless fitted with a protection strip, would fail because of the corrosive action of the products.

Mr. **R. Whiting** (Croydon), said that speaking as a consumer, he found that variation in water pressure sometimes made the getting of a bath a matter of no small agility with the tap. A water governor would cure this trouble. He would be interested to know if any of these governors had given trouble after some years use. It was completely immersed in water of varying hardnesses and as a result should be liable to troubles of various kinds. Would it not be better, within the limits of financial considerations, to have some form of overriding thermostatic control so that the water control gave excessive opening of the gas and that when the maximum water outlet temperature was reached the gas could then be controlled by this thermostatic apparatus? This would overcome summer and winter variations of temperature as well as variations in pressure. In conclusion, Mr. Whiting remarked that any pilot that did not burn continuously was of no value at all.

Mr. **Cooper** said that thermostats of the gradual operating type would cause condensation troubles, as sometimes the heater would be operating at gas rates below that for which it was designed. There had been a heater on the market some years ago which could be used in conjunction with a coke boiler; in this, if the temperature dropped the gas supply to the heater was automatically turned full on.

Mr. **G. F. Bedford** (Gas Light and Coke) said that the word "adequate" made him suspicious in regard to water governors, because the consumer was troubled by the minimum head of water at which the heater would operate. Did the installation of a water governor in any way increase the minimum operating head?

Mr. **Cooper** emphasized that the operation of the automatic valve was entirely unaffected by the water governor, provided the latter was properly designed. All those he had examined had been satisfactory; but a badly designed water governor would have the effect of greatly increasing the back pressure of the heater.

Losses After Leaving Heater

Mr. **J. R. Barralet** (New Geysers, Ltd.) said that he was glad to hear Mr. Cooper differentiate between laboratory efficiency and practical efficiency; but he noticed that he omitted to refer to the losses as the water left the heater—a consideration which came into the picture and was very much more marked in the case of the multi-point than with the single-point appliance, though it naturally depended upon the type of use to which the heater was put. In some instances a multi-point was obviously more suitable, but where small quantities of water were drawn off at infrequent intervals it reduced the working efficiency very materially. With regard to Mr. Whiting's point of a thermostatic control for instantaneous heaters, this had been tried; but the principal difficulty was the time lag before the thermostat came into operation, which resulted in boiling if one was not careful. But undoubtedly such a method of control had definite advantages if it could be properly arranged.

Mr. **Cooper** agreed that hot water was left in the pipe in the case of a multi-point heater, but he would not say that the working efficiency was much less than a single-point heater. It was less—but not much less. To provide automatic water heating throughout a house one must have at least two single-point heaters to do the work of one multi-point—and this brought in the question of costs. It must be remembered that the appliances cost money, and therefore the cost of getting hot water from two appliances might be less per gallon of water, but bearing in mind the cost of both appliances the cost per gallon might be considerably more than for one multi-point heater.

Mr. **R. W. Hilham** (Colchester) said that, generally speaking, multi-point heaters had two types of valve—namely, metal or diaphragm type. He supposed they both had individual advantages; but his experience showed that the diaphragm type was the best, though he was still convinced there were certain advantages in the all-metal type. They should, for instance, overcome the troubles of cracked and distorted diaphragms during cold weather.

Mr. **Cooper** observed that, bearing in mind what he had said with regard to automatic valves, the diaphragm type had one big advantage over the all-metal valve in that there were two chambers and one of them could be isolated. But in some cases the water went round the edge of the disc, and while there were designs of all-metal valve on the market which operated at settings as low as the diaphragm type, there was a marked difference between the two in regard to the closing force. Except for the distortion, which did not affect the working of the heater, he had experienced no trouble at all. He regarded the diaphragm as being one of the most reliable parts of the valve provided it was correctly made. When the M.A.N. waterless gasholder was first suggested engineers held up their hands in horror at the idea of using a canvas seal, but in practice it was found that in some cases the canvas lasted longer than the metal. In the same way the flexible part of the valve was among the most reliable parts of the whole water heater. If the diaphragm was made with unequal stress, however, this might lead to cracking.

(To be concluded.)

THEORY OF INDUSTRIAL GAS HEATING

By PETER LLOYD, B.A.Cantab., A.I.C.

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NEWCASTLE-UPON-TYNE AND GATESHEAD BILL

The Bill promoted this Session by the Newcastle-upon-Tyne and Gateshead Gas Company for the purpose of acquiring the Undertaking of the Morpeth Gas Company, extensions of area, and the erection of a new gasholder, came before a Committee of the House of Commons on Tuesday, April 16, and was continued on the following days.

THE Committee consisted of Mr. Arthur Reed (Chairman), Mr. Ritson, Mr. Loftus, and Sir John Train. The Company was represented by Mr. Sydney Turner, K.C., and Mr. Harold Willis. There were five opponents, one of whom—the Gosforth Urban District Council—was represented by Mr. Jacques Abady, K.C. The others—the Newcastle-upon-Tyne Corporation, the Seaton Valley Urban District Council, the South Shields Corporation, and the Tynemouth Corporation were represented by Mr. Craig Henderson, K.C., and Mr. Jacques Abady. The opposition was on a number of points including objection to the proposed basic and differential prices in the extended area, and to a proposed site for a new gasholder.

Mr. SYDNEY TURNER, explaining the objects of the Bill, said it was proposed to acquire the undertaking of the Morpeth Gas Company, to extend the limits of supply and for other purposes and there were five petitions against the Bill from local authorities out of the 28 local authorities who were interested in the proposals.

There was no opposition to the acquisition of the undertaking of the Morpeth Gas Company. So far as the extension of the limits of supply was concerned, these included the area of the Morpeth Gas Company, an area called the Stannington area, which was between the present Newcastle Company's area and the Morpeth area, and also the areas of Ashington and Newbiggin. The main opposition in respect of these extensions was as regards the proposed basic and differential prices. There was also opposition to the use of the site upon which it was proposed to erect a new gasholder, this site being on the borders of Newcastle and Gosforth.

Remarking that the Newcastle-on-Tyne and Gateshead Gas Company was one of the largest undertakings in the country, Mr. Turner said it had a capital of approximately £4,500,000, an area of supply of some 226 square miles—including a very large and important industrial area on both banks of the River Tyne—a population of about 1,000,000, and about 275,000 consumers. The sales of gas last year amounted to 7,413 million cu.ft. In 1929 it became a basic price company. In the meantime, in 1924, it acquired the undertakings of the Walker & Wallsend Gas Company and the Chester-le-Street Gas Company, and subsequently, in 1937, the undertaking of the South Shields Gas Company was taken over.

Counsel emphasized that in all the previous legislation relating to the Company there was provision for applications for revisions of price by the Company or local authorities every five years, but the present Bill abolished that and provided that such applications could be made at any time. Although the basic prices for the various areas were subject to revision in this way, it had been the consistent practice of Parliament and the Board of Trade to provide that the differentials should remain fixed and not subject to revision.

The Morpeth undertaking was owned by a statutory company, and the agreement for the transfer was made between the two companies on Nov. 1, 1939, subject to sanction by Parliament. The basic price proposed was 11d. per therm or a differential of 4.3d. The population of Morpeth was only 7,500 and the total capital of the Company was £34,000. The sales of gas last year amounted to 44,000,000 cu.ft.

Extensions of Area

Dealing with the proposed extensions of area of supply, in addition to the area of the Morpeth Company, it was pointed out that the Stannington area intervened between the Newcastle Company's existing limits and the Morpeth area and therefore it was obviously convenient for it to be included. Then there was the area of the Ashington Urban District Council and certain adjoining parishes. The position there was that some years ago the Ashington Urban District Council obtained powers to give a supply of gas but had never exercised them and the only supply of gas there came from a colliery in part of the urban district. An agreement had been come to with the Urban District Council that if within ten years after the conclusion of the war the Newcastle Company did not give a supply or was not prepared to give a supply on demand, then the Ashington area would cease to be within the limits of the Company's area of supply and the powers now possessed by the Urban District Council would be exercisable. Thus there would always be somebody entitled to give a supply in Ashington and there would not be overlapping powers.

In Newbiggin there was a population of 7,000 and some supply was now being given there by the Newbiggin Gas Company. The Bill provided that the Newcastle Company should not give a supply of gas within that part of the Urban District supplied by the Newbiggin Company without the consent of that Company.

Coming to the basic prices and differentials in the extended area, Mr. Turner said in Morpeth the basic price would be 11d., including a differential of 4.3d. per therm. In the Stannington area it would be 10.4d., the differential in this case being 3.6d. per therm; in Ashington the basic price would be 12.1d., including a differential of 5.5d., and in Newbiggin the basic price would be 16.8d. per therm, the differential there being 10.7d. The proposal of the Bill was that while the basic prices were subject to revision at any time, the differentials were to be fixed, as had been the case hitherto.

Discussing the method of arriving at the prices to be charged in the various areas, Counsel said it had been the practice of the Company for 38 years to take the distance from Newcastle Central Railway station, and for every 1,000 yards they added 0.2d. per therm of gas supplied on to the Newcastle charge for gas. From the figure so ascertained they made a deduction of 0.2d. per therm for the first 25,000 therms of gas supplied in the particular area and a further 0.2d. per therm for the next 50,000 therms. In that way it was possible for an outside area, by taking a large supply, to reach the actual figure charged in Newcastle. Actually, there were only one or two isolated cases in which the full differential was being charged to-day.

Dealing with the petitions against the Bill, he said the first question raised was whether the differentials had been fixed at a proper figure—and he contended that they had been fixed on a system which had been found to work well for many years, although he admitted it was not a scientific system.

Then it was being suggested that as in some areas a supply was not to be given until after the war—and that was admitted—the fixing of the differentials for those areas ought to be postponed and fixed at a later date by the Board of Trade. That was objected to by the promoters because of the delay which would be entailed, and the cost which would be incurred.

An attempt was also being made by some of the petitioners to have inserted in the Bill provision for the revision of the differentials, but the promoters strongly objected to altering the policy of the Board of Trade and Parliament in this matter. He asked the Committee not to alter the past policy of the House in this respect. The question of whether the differentials should be subject to revision was gone into at the time the South Shields undertaking was taken over, and Parliament decided that they should not. On that occasion, their accountant, Mr. White, had said that if the differentials were to be subject to revision, then he would ask for them to be fixed initially at a higher figure. Counsel emphasized that the differentials were maximum and not obligatory and that it was in the interest of the Gas Company to keep the price of gas as low as possible in order to stimulate business.

As to the proposed new gasholder, both the Newcastle-on-Tyne Corporation and the Gosforth Urban District Council objected to the site chosen on the ground that it would interfere with the amenities of the district, and also that the site was part of an area which had been scheduled for town planning purposes. On the latter point, Mr. Turner said he believed that no town planning scheme had yet been submitted, and as to the amenities, he handed the Committee photographs which, he said, showed that the neighbourhood of the site was at present unoccupied.

Finally, Mr. Turner mentioned a suggestion in one or two the petitions that a recommendation of a Joint Committee in 1937—which had not yet been applied generally—to the effect that a gas undertaking should not increase its charges more than 12½% without the consent of the Board of Trade, should be inserted in this Bill. He drew the attention of the Committee to the unfairness of imposing this on one isolated company because it happened to be in Parliament with a Bill, and he further pointed out that the circumstances of the present war had already made it necessary in many cases to increase prices by much more than 12½%. Here again he spoke of the delay and cost which would be involved in such applications to the Board of Trade and said that if his Company desired to increase its price by 2d. per therm, and there was a delay of nine months, as there might well be having regard to the enormous amount of other work which the Board of Trade had to do during the war, it would mean a loss of £250,000 to the Company.

Mr. T. P. RIDLEY (General Manager and Secretary of the Newcastle & Gateshead Gas Company) gave evidence and confirmed all that had been said in the opening statement by Mr. Turner.

Mr. CRAIG HENDERSON, cross-examined as to the reasons held by witness for not postponing the fixing of the differentials until after the war. It was put by Counsel that they did not know how long the war would last and what the economic conditions would be afterwards. Everything would have to be based on the prices of materials, &c., then prevailing, and the Company did not intend to develop in certain areas until after the war.

Mr. RIDLEY said that certain estimates had been made and in his view there was a good margin to allow for increases in the costs of materials later on. At the moment there was no big increase in prospect. He objected to postponing the fixing of differentials because the work in connexion with the added areas involved a timetable and the Company desired to be ready to go ahead at the very first opportunity. If they had to wait for the Board of Trade to fix the differentials there would be great delay.

Mr. A. W. WHITE (Messrs. Cash, Stone & Co., Chartered Accountants) gave evidence with regard to the new differential prices proposed, the suggestion that there should be revision of the differentials and the further suggestion that if the Company desired to increase its price by more than 12½% it could not do so without application to the Board of Trade. His views on these matters were in line with those previously expressed on behalf of the promoters.

Mr. JACQUES ABADY, for the Gosforth Urban District Council, challenged that view and said the Company could not make charges without statutory powers.

Mr. WHITE replied that the circumstances in the outside areas would be different and in the absence of a statutory differential, the Company could charge what it pleased. At the same time, he pointed out that the Company was not charging the full authorized differentials in any area now.

On Thursday, April 18, the whole day was occupied in hearing evidence from Mr. Edward Crowther, Chief Engineer to the Newcastle and Gateshead Gas Company.

Mr. CROWTHER agreed with the evidence previously given in support of the Bill and dealt in some detail with the proposed gasholder site. He said the holder which it was proposed to erect would have a capacity of 3 million cu.ft., and contended that no other site had been brought to his knowledge by the estate agent who had advised him which would fulfil the necessary conditions for a gasholder site. The primary object of erecting this holder was to increase the present storage capacity in a position where it would be most convenient to supply the areas to the north of Newcastle and generally to make the whole working of the undertaking in this respect more flexible than it was at present. The most important consideration was service to the consumers, and although he agreed that public amenities entered into such a proposition a great deal, he urged that the Company, in choosing this site, was not interfering with amenities to any great extent and that it would do everything to maintain the goodwill of the public.

Mr. CRAIG HENDERSON, for the Newcastle Corporation, emphasized that the site had been scheduled in a town planning scheme as a residential area but witness said there had been very little building there for many years and that that had been one of the considerations, from the point of view of amenities, which had influenced the Company in choosing the site. The total site scheduled was 4½ acres, of which 2 acres would be required for the holder.

When it was put to witness that the holder need not be erected and that the supply to the northern parts of the Company districts could be met by distributing gas at high pressure to certain points and then reducing down, Mr. Crowther replied that such a system would at once prevent the flexibility which was so much desired. He emphasized that this was not a rural supply but one of very great magnitude in a well populated area and he had estimated that the cost for power for compression would alone amount to £4,000 per annum. Even assuming that this would not mean a very large amount per therm, he repeated that such a system would leave him without the great advantage offered by a holder.

Mr. Crowther, answering Mr. Jacques Abady, for the Gosforth U.D.C.—which is also objecting to the use of the proposed site—said the holder would be the latest form of water-sealed holder, and added that the work would be proceeded with immediately if this Bill were sanctioned assuming, of course, the Company were allowed the necessary materials in the present emergency.

Mr. ABADY suggested that there was nothing in the Bill to prevent the Company from putting up any type of holder or more than one, if it so desired.

Mr. CROWTHER said he was giving an assurance to the Committee that one holder only would be erected and that it would be of the type he had mentioned. He added that no engineer of the Newcastle Gas Company dare come before a Parliamentary Committee and make statements which were not in good faith and whatever was now put before the Committee would be carried out.

Mr. ABADY said he was merely pointing out the position under the Bill and would be the first to say that the Newcastle Gas Company was one of the finest and best-managed undertakings in the country.

Mr. CROWTHER mentioned that the Company's present gasholder at St. Anthony's was built 40 years ago and the extensions to the area rendered it essential that there should be additional holder capacity.

The Committee adjourned until Tuesday, April 23.

Western Junior Gas Association

Meeting at Bristol

On Saturday, April 6, the opening meeting of the session of the Western Junior Gas Association was held at Bristol under the Presidency of Mr. A. BELL (Exeter).

In normal circumstances the 1939-40 session would have been concluded by the Annual General Meeting being held this month, but owing to difficulties due to the war and to weather conditions which have prevented members travelling the long distances necessary to attend meetings during the winter months, the Council were compelled to delay the opening of the session.

Members assembled in the Demonstration Theatre at "Radiant House," the headquarters of the Bristol Gas Company, and the Meeting was opened by the presentation to Mr. A. Tran (Reading) of the Presidential Certificate for the session 1938-39. This was followed by a discussion on wartime problems affecting the Gas Industry, the discussion being opened by Mr. **T. W. Clapham** (Bristol) who enumerated a number of difficulties which had been experienced at Bristol and explained how they had been overcome. Among other things, he mentioned effects of irregular coal deliveries, the use of artificial oxides for purification, blast protection of buildings and general works A.R.P. measures, and gas as a motor fuel.

Mr. **A. G. Holtham** (Cheltenham) gave his experiences of sales and hire-purchase difficulties and described a system of repairing air raid damage to mains which had been evolved at Cheltenham.

Mr. **E. A. Rhead** (Exeter) gave figures illustrating the increased cost of oxide purification and described the rebuilding of damaged purifier grids to avoid the necessity for complete replacement. He also described the use of motor car headlamp masks for use in lamps for outside use.

Mr. **H. L. G. Boot** (Cheltenham) described the works A.R.P. organization at Cheltenham and discussed steam economy and liquor concentration.

Mr. **R. Robertson** (General Manager, Bristol Gas Company) spoke of the temporary inconveniences which the Industry had to overcome and illustrated what permanent lessons are to be learned.

Mr. **W. J. Baker** (Bristol) described in detail a method which he had employed at Shanghai for preparing purifying material from iron borings and filings and also described some of the effects of H.E. and incendiary bombs which he had observed there.

Mr. **A. Bell** (President) gave a review of the sales policy which seemed to him best to suit present conditions and also spoke of electrical competition.

Mr. **J. E. Ackroyd** (Swindon, G.W.R.) described a method of prolonging the life of sandbags and stressed the advantages to be obtained from sectionalized distribution systems.

Mr. **O. Pincock** (Western-super-Mare) discussed wartime sales policy and reviewed questions affecting the use of gas as a motor fuel.

Mr. **T. Climo** (Portishead) suggested a mixture of fine ashes with a little cement as filling for sand bags; he said experience had shown it to have none of the disadvantages of sand or earth fillings.

Mr. **A. Tran** (Reading) spoke of coal supply difficulties and described the results which had been obtained when carbonizing coal from stock.

Mr. **J. Wesley Whimster** (Engineer and Manager, Bath) discussed the labour question and described a method employed at Bath to lengthen the life of purifier grids.

Mr. **L. R. Cowley** (Cheltenham) gave the results which had been obtained when carbonizing coal from stock and also described the making of purifier grids with concrete. He also mentioned the use of breeze blocks as an A.R.P. measure for blast protection and the production of blue gas in vertical retorts.

Mr. **S. A. J. Horrod** (Swindon) spoke of the efficient use of mechanical coal-handling devices and of the economies of waste steam utilization.

Mr. **S. B. Jones** (Clevedon) stressed the seriousness of diminishing coal stocks and spoke of the vital need of replenishment before next winter.

Mr. **Noel S. Smith** (Bristol) gave some figures concerning the cost of using gas as a motor fuel and discussed the A.R.P. "starlight."

At tea, which was provided by the Bristol Gas Company, Mr. J. WESLEY WHIMSTER presented Mr. A. Tran, the retiring President, with an engraved silver tankard on behalf of the members of the Association as a memento of his year of office. Mr. TRAN suitably replied.

The PRESIDENT, after tea, announced that the Council had decided to arrange a series of meetings throughout the summer months and trusted that they would be well supported.

The thanks of the Association to the Bristol Gas Company for their hospitality were expressed by Mr. W. J. ACKROYD and seconded by Mr. S. B. JONES.

Mr. R. ROBERTSON, in reply, said that he and his Directors were always ready to do anything to assist the Junior Association.

COMMERCIAL GAS COMPANY'S BILL

This Bill came before the Unopposed Committee of the House of Commons on Wednesday, April 17. The purpose of the Bill was to remove certain disabilities imposed in previous legislation, and there was a lengthy report from the Board of Trade on a number of the proposed clauses

CLAUSE 4 deals with the issue of capital, and it was pointed out to the Committee that it is vitally important that the Company should be able to issue capital quickly on the best terms. In the present circumstances it would probably be best to issue redeemable preference stock or debentures. At the present the Directors have full discretion as regards the issue of Debenture Stock and the Clause now proposed to give them similar discretion with regard to ordinary and preference stock. The Clause was taken word for word from the Gas Light and Coke Company's Act of 1936, and there was agreement with the London County Council on the matter. Also, none of the local authorities concerned had raised any objection. The Board of Trade, however, in their report asked the Committee to be satisfied that the circumstances were the same as in the case of the Gas Light and Coke Company, and intimated that the Commercial Gas Company was a smaller undertaking. It was also suggested in the Report that there were only infrequent quotations of the Commercial Gas Company's stocks on the Stock Exchange, but it was pointed out to the Committee that the Company's stocks appeared in the Daily Stock Exchange List with the date of the last transaction.

Mr. E. A. PEARCE, of Messrs. Seymour Pearce & Co., Stockbrokers, gave evidence in favour of the Directors having full discretion in the manner in which capital should be issued and said that in the case of the issue of £140,000 of preference stock issued in 1938 it would have been possible to save £3,500 on the issue had the Directors been able to act promptly, instead of following the usual procedure which entailed delay.

The Committee passed the Clause.

In Clause 5, the Company sought authority to increase its present borrowing powers of 70% of the issued preference stock and debentures, to 100%. Again, it was stated that the L.C.C. was satisfied and that there was no objection from the local authorities. The Board of Trade, however, in their report said that while in a few cases they had sanctioned 100% borrowing powers, they thought it was undesirable as a general proposition that there should be a large amount of loan capital ranking, before the share capital. They, therefore, asked the Committee not to extend the present proportion of 70% unless good reasons were put forward.

Two other Clauses were taken at the same time—viz., Clauses 7 and 8. The former asked powers to set aside from revenue the sum of £10,000 per annum as a capital redemption fund, the object being to meet the value of old works which had been dismantled, the fund not to exceed £125,000. Thus this amount would be reached in about 12 years, and once again the Committee was told that the L.C.C. was offering no objection.

By Clause 8, the Company sought powers to increase from £350,000 to £500,000 the amount of ordinary stock which it may purchase out of the proceeds of issues of debenture stocks under powers obtained in 1932. Already the Company has purchased and extinguished stock to the value of £298,000 in this way so that the maximum of £350,000 was almost reached. The Company therefore desires to increase the maximum amount in order to continue to reduce the capital charges.

The Committee passed all three clauses.

Clause 11 was also passed. It relieves the Company from the obligation to notify all of its 104,000 consumers three months in advance of a change in calorific value, although the obligation to notify the Board of Trade, the London County Council, and the local authorities still remains. In place of notifying consumers individually, the change will be notified in the London Gazette. The difficulty of giving three months' notice to consumers at the present time was emphasized before the Committee on the grounds of the demands of the Government for residuals for munition purposes, which might demand an instant change in the calorific value, although, it was pointed out, the consumer did not suffer, as he paid on the heating value. There might be a little more time taken for cooking or heating with a lower calorific value gas, but it would be so slight as not to be noticed.

Finally, there was discussion of Clause 29. It was explained to the Committee that the present Bill was a compulsory promotion as the Company was compelled by previous legislation to promote a Bill in Parliament to give local authorities the opportunity of bringing before Parliament observations with regard to the Company's basic price. By arrangement with the L.C.C., the date 1950, which was originally in the Bill for the next similar promotion, had been altered to 1945. The Board of Trade, in its Report, pointed out to the Committee that one of the recommendations of the Joint Committee of the House of Lords and Commons on Gas Prices was that the basic price and dividend system should be retained and that local authorities could at any time make application to the Board of Trade for a revision. On behalf of the Company, however, it was emphasized that the Joint Committee's recommendations—which were five in number—had not been acted upon and were a matter for general legislation. Some of the other recommendations favoured the gas companies and, therefore, it was unfair to ask that one recommendation which was not in favour of the Company should be applied in these circumstances, while the others were not mentioned. In any case, it was argued that the application of the recommendations of the Joint Committee was a matter for general legislation.

The Committee once again sanctioned the Clause as it appeared in the Bill, and the whole measure was sent forward for third reading.

Zinc Annealed Iron

Corrosion and Heat Resistance

In accordance with a request by the National Gas Association of Australia, the Australian Gas Light Company recently carried out corrosion and heat resistance tests on zinc annealed iron. The following is taken from the report issued on the investigation.

Zinc annealing is a comparatively new process for the protection of sheet iron, and may be obtained in two finishes —namely, dull or mat, and polished. The crystalline appearance of galvanizing does not exist with this coating. It is claimed by the manufacturers that the zinc penetrates the iron and that there is no really definite exterior coating, but more of an alloying effect.

The object of the tests was to determine the suitability of the material as a corrosion resistant flue pipe, and for the manufacture of the external casing of gas wash coppers.

A 4 ft. length of zinc annealed flue pipe, and a similar length of tinned copper flue pipe, were arranged so that the products of combustion from a bath heater would pass through them. In order to promote condensation, metal condensers were arranged to jacket the pipes for a distance of 2 ft. The condensation products were collected and measured, and the dampers on the pipes adjusted to give equal condensation in each case.

After 200 hours operation it was noticed that the condensate from the zinc annealed pipe contained a large quantity of rust. An examination of the interior revealed that the surface of the zinc annealed pipe was badly rusted at condenser level.

The test was continued for a further 100 hours (a total of 300 hours' service), when the arrangement was dismantled, the condensers removed, and the pipes opened. It was found that the zinc coating on the zinc annealed pipe had been almost entirely replaced by a loosely adherent film of rust. A micro-examination of the coating revealed that the alloying between the zinc and iron did not exist, but that the zinc anneal was present in a clearly defined exterior coating very adherent in its nature.

It is contended, therefore, that the claims for the material in this regard are without foundation, and that there is no greater zinc penetration than that obtained with other zinc coatings.

As a result of the unsatisfactory performance of the preliminary tests for resistance to corrosive condensate, the proposed small-scale tests to produce definitely comparative results between this and other types of coating were abandoned.

Gas Wash Coppers

Section 6, Part 2, of the National Gas Association Approval Requirements for gas wash coppers specifies that there shall be no apparent discoloration or deterioration of the finish of the outer casing when the copper is operated for a period of 10 hours at the maximum thermal input rate, and experience has shown that galvanized iron will not comply with this requirement.

One copper with a galvanized outer casing successfully

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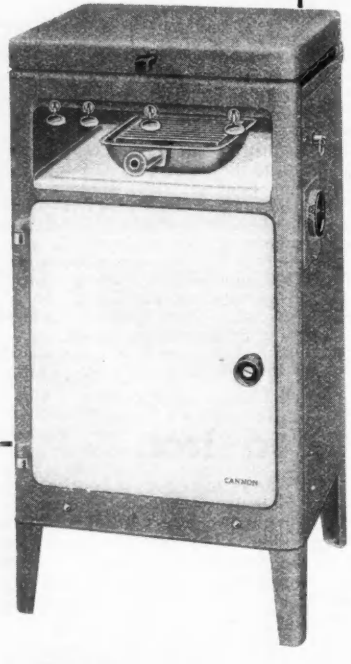

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withstood this test and was passed as satisfactory. It was subsequently found, however, while the copper was awaiting collection by the manufacturers, that the galvanized coating had commenced to lift and peel off. Other coppers tested showed signs of peeling before the finish of the tests.

It was concluded from the above tests that variations in the performance of galvanized coatings would occur and would depend upon the efficiency of galvanizing, but even at its best galvanizing would find it difficult to outlast the 10 hour test.

Two coppers with zinc annealed outer casings were tested, one with a mat and the other with a polished surface. The appearance of both coppers before testing was superior to coppers encased with galvanized iron. After 10 hours test at the maximum thermal input rate a slight discoloration in the vicinity of the burners was apparent, but no scaling of the coating took place. Examination, after standing for fourteen days, did not reveal any tendency for the coating to lift.

These tests would indicate that the zinc annealing is more adherent than galvanizing and is much superior to galvanizing for the construction of the outer case of gas wash coppers.

Conclusions

The claims put forward by the manufacturers in regard to corrosion resistance for zinc annealing are not substantiated, and for the construction of flue pipes it is little, if any, better than galvanizing.

For the construction of the outer casing of gas wash coppers, zinc annealed sheet is much superior to galvanized iron, and although a slight discoloration contiguous to the burner was obtained, its adoption for this purpose can be recommended.

Two-Part Tariff Prepayment Meters

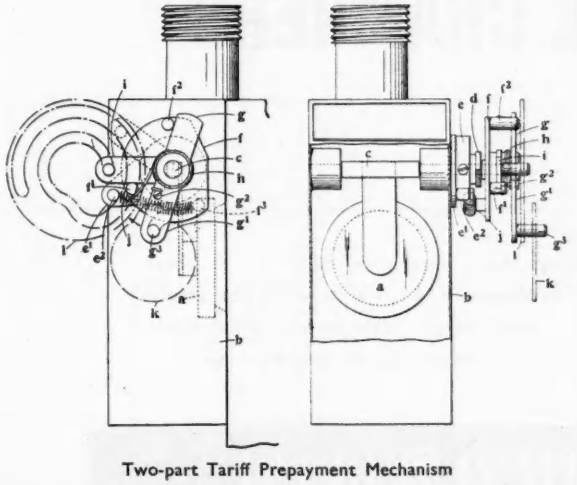
Ingenious Mechanism

Among recent patents is one (No. 518,078; application date Aug. 11, 1938) concerning two-part tariff prepayment meters which has been granted to United Gas Industries, Ltd., E. W. Smith, and A. C. and A. J. Christian. One of the mechanisms controlling the operation of the valve is adapted to operate on prepayment of the basic charge. A second mechanism, also controlling the valve, operates on prepayment of the commodity rate. It is subordinate to the first mechanism to ensure that no gas is supplied while there remains due any of the basic charge.

Fig. 1 is a side elevation of a valve casing for a gas meter provided with control mechanism according to the invention.

Fig. 2 is an end elevation of the valve casing represented in Fig. 1, part of the casing being removed to expose the gas valve.

The valve *a*, which serves as the inlet valve and is mounted in the usual manner within a valve casing *b*, is carried by a spindle *c* which extends outwardly at the side of the valve casing



Two-part Tariff Prepayment Mechanism

through a gland *d* and stuffing box *e*. Immediately adjacent the gland the spindle carries a disc *f* in fixed relation thereto. A double arm *g*, g^1 is loosely mounted upon the valve spindle and subjected to the force exerted by a spirally coiled spring *h* mounted about its boss and anchored at the ends respectively by a stop pin f^1 on the disc and by a diverted end which bears against the lateral edge of the part g^1 of the arm. This diverted end of the spring is maintained in position by a screwed pin g^2 mounted in the part g^1 of the double arm.

The disc *f* has a stop pin f^2 in a determined position to arrest the rotation of the double arm *g*, g^1 under the action of the spring *h*. A second arm *i* is rotatably mounted upon the spindle *c* between the boss of the double arm *g*, g^1 and the boss of the disc, this second arm being disposed in a position between the stop pin determining the movement of the transversely disposed arm and the stop pin f^1 for the spring *h* of the arm. The stuffing box is provided immediately adjacent the valve casing with a bracket plate e^1 in fixed relation, which bracket plate carries a pin e^2 for the anchoring of one end of a coiled spring *j*, the other end of which is anchored to a pin f^3 upon the adjacent face of the disc in such manner that the tension of the spring *j* tends to maintain the inlet valve open. The disc *f* may be of any suitable shape and may comprise merely a number of radiating arms.

The double arm is adapted to serve as the operating member under the control of the second control mechanism. Thus, it is adapted to be controlled by a control element such as a disc cam *k* that is in fixed relation to the driven element of a Maltese cross mechanism receiving the drive from a coin mechanism in one direction and from the metering mechanism of the meter in the other direction. The second arm *i*, serving as the operating member under the control of the first control mechanism, is mounted under the control of a control element, such as a disc cam *l*, operated by a time control mechanism, and also, if required, driven through a Maltese cross mechanism, the arrangement being such that when the time control mechanism is adjusted to the position at which the inlet valve *a* is closed—that is to say, at the position when the prepaid basic charge has been fully credited and arrears are about to begin—the second arm *i* is maintained in a position in which it presses against the anchoring pin f^1 of the spring *h* of the double arm.

Thus, while in the operation of the prepayment mechanism the double arm may be caused to take up a position corresponding to opening of the valve *a*, the arm is caused to move against the action of the coiled spring *h* without being effective to open the valve, which is retained closed by the second arm *i*. Immediately payment of the arrears and prepayment of further basic charge has been effected the second arm *i* is caused to move into the dotted line position in a direction to permit the rotation of the disc *f* under the action of the coiled spring of the double arm and of the spring *j* to open the valve.

In the construction such as that illustrated in the accompanying drawings in which the valve is subjected to a force always tending to open it and is maintained in the closed position by the operation of the arms *g*, g^1, and *i*, the control member *k* may be of a simple disc-like form provided with a substantially radial slot at one position upon the periphery, into which slot the pin g^2 on the part g^1 of the arm *g*, g^1 may be received when the arm is in the position corresponding to that in which the valve is closed. When, by prepayment, the control member is rotated, the arm is caused to move in the clockwise direction by reference to Fig. 1 for the purpose of opening the valve. Where, however, movement of the disc *f* is under the control of the second arm *i* the movement of the arm *g*, g^1 is not effective to permit the valve to open if the second arm *i* remains in the position in which it rests against the stop pin f^1.

Where the arm *i* is under the control of a time control mechanism provided for the purpose of charging a basic charge such as rent, the control element or cam *l* requires to be of a form to control the movement of the arm *i* in the two directions unless the arm *i* is mounted under the action of a force such as that of a spring tending to move it in the anti-clockwise direction with reference to the spindle *c* (Fig. 1). In order that arrears of the basic charge may be accounted the movement of the arm *i* into the position in contact with the stop pin f^1 in which the valve *a* is maintained closed is advantageously effected by suitable formation of the controlling edge or edges of the cam *l* and by a concentric continuation of the said slot about the axis of rotation of the cam *l*.

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GAS STOCKS AND SHARES

The proximity of the Budget caused a slowing down of business on the Stock Exchange last week, while the possibilities of an extension of the war to other neutral countries also had a depressing effect. Despite these disturbing elements the general undertone remained firm and prices moderately well maintained. A satisfactory feature was the strength of British Funds which, under the influence of good support, showed improvements on the week; 2½% Consols closed ½ higher at 72½. Home rails remained weak, although a few buying orders at lower levels brought about a steadier appearance towards the end of the week. Apart from a fall in the values of those shares which may possibly be adversely affected by the Budget, industrials generally showed little change. Oil shares were depressed and rubbers and mines remained idle.

There were no special features in the Gas Market, but the section was not neglected, and during the early part of the week considerable support was forthcoming for Gas Light units and South Metropolitan stock. Prices on the whole continued steady and with few exceptions the changes were in an upward direction. Alliance and Dublin hardened 2 to 112½, and a demand for Croydon sliding scale and maximum dividend stocks led to gains of 2 and 3 points respectively. On the other hand, a sharp set-back occurred in British ordinary, and with the stock changing hands at 93 the price fell 6 to 97. Gas Light units were irregular towards the end of the week and finally closed 3d. lower at 16s. 6d. On the Provincial Exchanges higher quotations were reached by Bath, Bristol, Liverpool, and Sheffield ordinaries, while in the Supplementary List it will be noticed that Lea Bridge 4% debenture rose a further 8 points to 90½, following a gain of 5 a week ago; business was recorded at 89.

The accounts of the Bombay Gas Company for 1939 show a net profit of £29,951 (against £25,966 for 1938). As announced last week, the dividend is maintained at 8%, and the carry-forward will be £48,780, against £45,646 brought in.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 19.	Rise or Fall on Week.
1,767,439	Mch. 11	8	7	Alliance & Dublin Ord. ...	110—115	+2
374,000	Dec. 27	4	4	Do. 4 p.c. Deb. ...	80—90	...
877,576	Nov. 6	5	5	Asscd. Gas & Water U'd'ts Ord.	14/6—16/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6	...
535,545	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	15/—17/—	...
318,730	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	13/6—15/6	...
750,000	Mch. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	82—87	...
560,070	Feb. 19	7	7	Barnet Ord. 7 p.c.	122—127	...
300,000	Apl. 8	1/4⅝	1/9⅜	Bombay, Ltd.	19/6—21/6*	...
181,915	Feb. 26	9½	9½	Bournemouth Sliding Scale ...	145—150	...
690,526	,,	7	7	Do. 7 p.c. max. ...	118—123	...
493,960	,,	6	6	Do. 6 p.c. Pref. ...	116—121	...
50,000	Dec. 18	3	3	Do. 3 p.c. Deb. ...	70—75	...
362,025	,,	4	4	Do. 4 p.c. Deb. ...	95—100	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...
357,900	Feb. 19	7½	6¾	Brighton, &c., 6 p.c. Con. ...	103—108	...
659,955	,,	6¾	5⅞	Do. 5 p.c. Con. ...	100—105	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref. ...	103—108	...
855,000	Mch. 11	7	8	British Ord.	92—102	−6
100,000	Dec. 18	7	7	Do. 7 p.c. Pref.	120—125	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb.	75—80	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb.	100—105	...
100,000	22 May '33	6	4	Cape Town, Ltd.	¼—¾	...
100,000	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref.	¼—¾	...
150,000	Dec. 18	4½	4½	Do. 4½ p.c. Deb.	53—58	...
626,860	Jan. 29	6	5⅞	Cardiff Con. Ord.	103—108	...
237,860	Dec. 18	5	5	Do. 5 p.c. Red. Deb. ...	95—100	...
98,936	Apl. 8	2/—	2/—	Colombo Ord.	1¼—1¾*	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref.	20/—22/—*	...
739,453	Mch. 26	−/11.48	−/11.48	Colonial Gas Assn. Ltd. Ord. ...	14/6—16/6	...
296,144	,,	1/3.30	1/3.30	Do. 8 p.c. Pref.	20/—22/—	...
1,775,005	Jan. 29	4	2	Commercial Ord.	47—52	...
140,000	Feb. 19	4	4	Do. 4 p.c. Red. Pref. ...	87—92	...
620,000	Dec. 11	3	3	Do. 3 p.c. Deb.	62—67	...
286,344	Feb. 19	5	5	Do. 5 p.c. Deb.	95—100	...
200,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
807,560	Feb. 12	7	7	Croydon sliding scale	100—105	+2
644,590	,,	5	5	Do. max. div.	87—92	+3
620,385	Dec. 7	5	5	Do. 5 p.c. Deb.	100—105	...
208,660	Feb. 19	5	5	Dudley, Brierley Hill & Dist. Ord.	98—103	...
82,275	,,	5	5	Do. 5 p.c. Con. Pref. ...	93—98	...
79,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
239,000	Jan. 29	5	88/6	East Hull Ord. 5 p.c.	70—80	...
187,215	Feb. 12	5½	5½	East Surrey Ord. 5 p.c. ...	93—98	...
176,211	Dec. 18	5	5	Do. 5 p.c. Deb. ...	100—105	...
250,000	Nov. 13	8	4	Gas Consolidation Ord. 'B' ...	15/—17/—	+−/6
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
19,152,410	Jan. 29	5⅜	3⅜	Gas Light & Coke Ord. ...	16/—17/—a	−/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max.	62—67	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	86—91	...
2,993,000	Jan. 2	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	87—92	...
8,602,497	Nov. 27	3	3	Do. 3 p.c. Con. Deb. ...	75—80	−2
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	105—110	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	102—107	...
700,000	Mch. 11	3½	3½	Do. 3½ p.c. Red. Ded. ...	87—92	...
270,466	Feb. 19	6	6	Harrogate New Cons.	93—98	...
157,500	Apl. 8	‡1/—	‡1/—	Hong Kong and China Ord. ...	⅝—¾*	...
5,600,000	Oct. 23	12	4	Imperial Continental Cap. ...	72—77	−1
172,810	Jan. 29	3½	3½	Do. 3½ p.c. Red. Deb. ...	80—85	...
63,480	Dec. 18	3	3	Maidstone 3 p.c. Deb.	55—60	...
45,000		†10	†8	Malta & Mediterranean ...	92—102	...
				Metropolitan (of Melbourne) ...		
392,000	Apl. 1	5½	5½	5½ p.c. Red. Deb.	93—98	...
231,977	Feb. 19	5	5	M.S. Utility 'C' Cons.	75—80	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref. ...	82—87	...
390,076	Dec. 18	4	4	Do. 4 p.c. Deb. ...	85—90	...
148,955	Dec. 18	5	5	M.S. Utility 5 p.c. Deb. ...	103—108	...
125,000	Jan. 2	3½	3½	Do. 3½ p.c. Red. Bds. ...	90—95	...
675,000	Nov. 6	†3	†4	Montevideo, Ltd.	60—65	...
250,000	Mch. 18	7½	5⅞	North Middlesex 6 p.c. Con. ...	103—108	...
396,160	Jan. 29	5	5	Northampton 5 p.c. max. ...	90—95	...
300,000	Nov. 6	†7	9	Oriental, Ltd.	115—120	...
468,537	Dec. 11	8	7	Plymouth & Stonehouse 5 p.c.	118—123	...
621,667	Feb. 5	8½	8½	Portsmouth & Gosport Cons.	110—115	...
241,446	,,	5	5	Do. 5 p.c. max.	85—90	...
73,350	,,	5	5	Do. 5 p.c. Pref.	90—95	...
75,000	,,	4	4	Do. 4 p.c. Pref.	75—80	...
114,000	Feb. 5	5	5	Preston 5 p.c. Pref.	88—93	...
247,966	Dec. 18	4	4	Primitiva 4 p.c. Cons. Deb. ...	93—98	...
625,959	Jan. 15	4	4	Do. 4 p.c. Red. Deb. ...	91—96	...
15,000	Mch. 11	6	6	San Paulo 6 p.c. Cum. Pref. ...	7⅛—8⅛	...
441,275	Oct. 9	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	17/—19/—	...
460,810	Mch. 11	−/10⅜	−/10⅜	,, ,, 4½ p.c. Cum. Pref. ...	16/6—18/6	...
133,201	Feb. 12	8⅛	5	Shrewsbury 5 p.c. Ord. ...	105—115	...
9,000	June 5	†4	†4	South African Ord.	4—5	...
1,996,297	Aug. 21	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	16/—18/—	...
1,000,000	Mch. 4	−/10⅜	−/10⅜	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6	...
769,191	,,	4	4	Do. 4 p.c. Cum. Pref. ...	15/—17/—	...
450,000	Feb. 12	4	4	Do. 4 p.c. Red. Deb. ...	95-100	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	89—94	...
6,709,895	,,	5	4	South Met. Ord.	69—74	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	107—112	+1
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	80—85	...
1,895,445	Dec. 27	3	3	Do. 3 p.c. Deb.	72—77	+1
1,000,000	Jan. 15	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
600,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	92—97	...
1,543,795	Feb. 5	6	3	South Suburban Ord. 5 p.c. ...	77—82	...
512,925	,,	5	5	Do. 5 p.c. Pref.	95—100	...
500,000	,,	4	4	Do. 4 p.c. Pref.	82—87	...
250,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	89—94	+3
888,587	Dec. 11	5	5	Do. 5 p.c. Deb.	105—110	...
250,000	,,	4	4	Do. 4 p.c. Deb.	85—90	...
200,000	Feb. 12	3½	3½	Do. 3½ p.c. Red. Deb. ...	87—92	...
427,859	Apl. 15	−/9⅜	1/2⅜	S. Western Gas & Water Ord.	13/—15/—*	−−/6
160,523	,,	−/10⅜	−/10⅜	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6*	−−/6
110,000	Dec. 18	4	4	Do. 4 p.c. Red. Deb. ...	90—95	...
750,541	Feb. 5	5	5½	Southampton Ord. 5 p.c. ...	77—82	...
148,836	Dec. 27	4	4	Do. 4 p.c. Deb. ...	85—90	...
350,000	Feb. 12	5½	5½	Swansea 5½ p.c. Red. Pref. ...	97—102	...
200,000	Dec. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—100	...
1,076,490	Feb. 26	6½	5	Tottenham and District Ord....	94—99	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref.	103—108	...
62,235	,,	5	5	Do. 5 p.c. Pref.	95—100	...
453,380	Dec. 11	4	4	Do. 4 p.c. Deb.	85—90	...
1,247,505	Oct. 23	6	4	U. Kingdom Gas Cor. Ord. ...	14/—16/—	...
1,085,952	Nov. 20	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	15/—17/—	...
772,709	,,	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	14/6—16/6	...
745,263	Dec. 18	4½	4½	Do. 4½ p.c. 2nd Non-Cum. Pf.	13/6—15/6	...
1,093,656	Mch. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	84—89	...
378,106	Mch. 11	7	7	Uxbridge, &c., 5 p.c.	95—100	−2½
133,010	,,	5	5	Do. 5 p.c. Pref. ...	95—100	...
1,371,138	Feb. 5	6½	3½	Wandsworth Consolidated ...	88—93	...
2,525,768	,,	4	4	Do. 4 p.c. Pref.	84—89	...
1,343,964	Dec. 18	5	5	Do. 5 p.c. Deb.	103—108	...
383,745	,,	4	4	Do. 4 p.c. Deb.	85—90	...
400,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	90—95	...
558,342	Jan. 29	6½	6	Watford and St. Albans Ord. ...	95—100	...
200,000	,,	5	5	Do. 5 p.c. Pref.	95—100	...
200,000	,,	5½	5½	Do. 5½ p.c. Pref.	100—105	...
200,000	,,	4	4	Do. 4 p.c. Rd. Pf. (1973/8)	85—90	...
100,000	,,	33/4§	4	Do. 4 p.c. Red. Pf. (1959)	93—98	...
200,000	Dec. 11	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88	...

a.—The quotation is per £1 of Stock. * Ex. Div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Contd.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Apl. 19.	Rise or Fall on Week.
202,152	Mch. 18	5	5	Ascot Ord.	80—85	...
128,182	Dec. 27	5	5	Do. 5 p.c. Pref. ...	88—93	...
31,035	Mch. 4	-/9⅝	-/9⅝	Associated Utilities 4 p.c. Pref.	15/—17/-	...
100,000	Dec. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
17,000	Feb. 19	8	8	Bognor Orig. Ord. 'A' ...	102—112	...
62,210	,,	8	8	Do. New Add. 'A' ...	102—112	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	95—105	...
37,440	Jan. 29	10	10	Cam. Univ. & Town 10 p.c. max.	145—155	...
125,970	,,	7	7	Do. 7 p.c. max.	105—115	...
39,025	,,	5	5	Do. 5 p.c. max.	80—90	...
96,410	Jan. 29	4½	4½	Cardiff 4½ p.c. Pref.	90—95	...
55,520	Feb. 19	6	6	Colchester 6 p.c. Pref.	95—100	...
90,550	Mch. 18	5	5	Do. 5 p.c. Deb. ...	98—103	...
150,000	Feb. 12	4	4	Croydon 4 p.c. Pref.	82—87	...
130,000	Dec. 27	4	4	Do. 4 p.c. Deb.	85—90	...
65,000	Mch. 4	7½	6⅞	Eastbourne 'A' 5 p.c.	105—115	...
198,000	,,	6	5⅝	Do. 'B' 3½ p.c.	90—100	...
112,312	,,	5	5	Do. 5 p.c. Pref.	90—95	...
130,000	Dec. 18	5	5	Do. 5 p.c. Deb.	98—103	...
130,500	Feb. 19	7½	7½	Exeter New Ord. (£10) ...	12—14	+2
24,000	Aug. 21	8½	8½	Gt. Yarmouth 8½ p.c. max. (£30)	15—20	...
59,400	,,	7½	7½	Do. 7½ p.c. max. (£30) ...	10—15	...
51,160	Dec. 11	5½	5½	Do. 5½ p.c. Deb.	102—107	...
152,600	Feb. 26	8	9	Guildford Cons.	110—120	...
54,055	,,	5	5	Do. 5 p.c. Pref.	90—95	...
68,250	Dec. 11	5	5	Do. 5 p.c. Deb.	90—95	...
156,600	Feb. 19	7	5	Hampton Court Cons. ...	75—85	...
86,046	June 19	‡4½	‡5	Holyh'd&N.W.G.&W.Cpn.Ord.	13/6—15/6	...
80,000	Feb. 12	4	4	Lea Bridge 4 p.c. Pref.	65—75	...
60,000	,,	6	6	Do. 6 p.c. Pref.	105—115	...
94,876	Dec. 18	4	4	Do. 4 p.c. Deb.	88—93	+8
73,620	Mch. 18	8¾	8¾	Luton Cons. 'A'	115—125	...
107,960	Feb. 26	4	5½	Mid Kent Ord. (£10)	7½—8½	...
230,940	Feb. 5	10	10	Oxford & District Ord. ...	135—145	...
47,112	,,	5	5	Do. 5 p.c. Pref.	85—90	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
126,193	Oct. 30	7½	7½	Peterborough Ord.	140—150	...
64,990	Mch. 18	7	7	Redditch Ord.	100—110	...
166,850	Feb. 19	8	8	Romford Ord.	108—118	...
60,000	,,	4	4	Do. 4 p.c. Pref.	85—90	...
44,000	Mch. 18	5	5	Do. 5 p.c. Deb.	97—102	...
25,570	Feb. 12	5½	5½	Rugby 5½ p.c. Pref.	95—105	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
42,750	De .. 11	5½	5½	Do. 5½ p c. Deb.	103—108	...
110,950	Feb. 26	8	8	Ryde Ord.	100—110	...
270,086	Mch. 18	7	7	Slough Ord.	98—103	...
21,000	Dec. 11	5	5	Do. 5 p.c. Deb.	92—97	...
28,872	Nov. 6	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	14/—16/-	...
28,866	Mch. 18	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	14/—16/-	...
127,228	Feb. 19	5	7	Swindon Cons.	75—80	...
60,425	Dec. 18	5	5	Do. 5 p.c. Deb.	92—97	...
64,380	,,	5	5	Torquay & Paignton 5 p.c. Pref.	82—87	...
130,000	Feb. 12	5	5	Wakefield Ord.	85—95	...
81,650	,,	5	5	Do. 5 p.c. max.	75—80	...
82,000	Jan. 29	6	6	Weymouth Ord.	82—87	...
273,626	Feb. 12	7	7	Wolverhampton Cons. Ord. ...	115—120	...
98,384	,,	6	6	Do. 6 p.c. Pref.	105—115	...
160,000	Dec. 18	5½	5½	Do. 5½ p.c. Red. Deb. ...	100—105	...
106,490	Mch. 18	5½	5½	Wrexham Ord	75—85	...
90,000	Dec. 18	5	5	York 5 p.c. Red. Deb.	95—100	...
133,640	Feb. 19	6	6	Yorktown (Cam.) 5 p.c. Cons.	82—87	...
120,000	,,	5	5	Do. 5 p.c. Pref.	85—90	...
35,000	Dec. 18	5½	5½	Do. 5½ p.c. Deb.	103—108	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 19.	Rise or Fall on Week.
347,756	Feb. 12	5	6	Bath Cons.	103—106	+1
1,667,250	Feb. 5	5	5	Bristol, 5 p.c. max.	105—107	+1
120,420	Dec. 18	4	4	Do. 1st 4 p.c. Deb.	98—101	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb. ...	98—101	...
328,790	,,	5	5	Do. 5 p.c. Deb.	115—117	...
274,000	Feb. 26	5	5	Newport (Mon.) Ord.... ...	91—94	...
13,200	Mch. 26	7	8½	Pontyp'l Gas & W. 10 p.c. 'A'	11¾—12¾	...
13,600	,,	5	6	Do. 7 p.c. 'B'	10½—10¾	...
40,000	,,	5	6	Do. 7 p.c. 'C'	10½—10¾	...
140,778	Feb. 12	5	5	Weston-super-Mare Cons. ...	92—96	...
64,338	Dec. 27	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	140—150	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 19.	Rise or Fall on Week.
157,150	Feb. 5	5	6½	Chester 5 p.c. Ord.	98—101	...
92,500	Dec. 18	4	4	Do. 4 p.c. Pref.	80—84	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	85—88	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—99	...
2,167,410	Feb. 19	6	6	Liverpool 5 p.c. Ord.	107—109	+1
245,500	Dec. 18	5	5	Do. 5 p.c. Red Pref. ...	95—100	...
306,083	July 17	4	4	Do. 4 p.c. Deb.	99—101	...
106,280	Feb. 5	10	8	Preston 'A' 10 p.c.	165—175	...
188,219	,,	7	7	Do. 'B' 7 p.c.	123½—133½	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 19.	Rise or Fall on Week.
122,577	Feb. 19	7	7	Blyth 5 p.c. Ord.	113—118	...
732,000	Feb. 19	4	4	Hartlepool G. & W. Co. & New	63½—64½	...
2,430,267	Feb. 5	5	5 7/10	Newcastle & Gateshead Con.	20/—21/—a	...
682,856	,,	4	4	Do. 4 p.c. Pref.	92—94	+3
776,706	Dec. 27	3½	3½	Do. 3½ p.c. Deb.	84—86	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	102—104	...
332,351	Feb. 5	6	6	Sunderland 6 p.c. max. ...	111—113	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 19.	Rise or Fall on Week.
542,270	Feb. 12	6	9	Derby Con.	103—108	...
55,000	Dec. 18	4	4	Do. 4 p.c. Deb.	98—103	...
20,000	Dec. 18	5	5	Long Eaton 5 p.c. Pref. ...	9—11	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	100—105	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 19.	Rise or Fall on Week.
10,000	Feb. 19	10	10	Great Grimsby 'A' Ord. ...	170—180	...
6,500	,,	10	10	Do. 'B' Ord. ...	170—180	...
79,000	,,	10	10	Do. 'C' Ord. ...	160—170	...
1,806,339	Feb. 26	6½	6½	Sheffield Cons.	125—127	+2
95,000	Jan. 2	4	4	Do. 4 p.c. Deb.	98—100	...

a The quotation is per £1 of Stock.
* Ex. div. ‡ For year.

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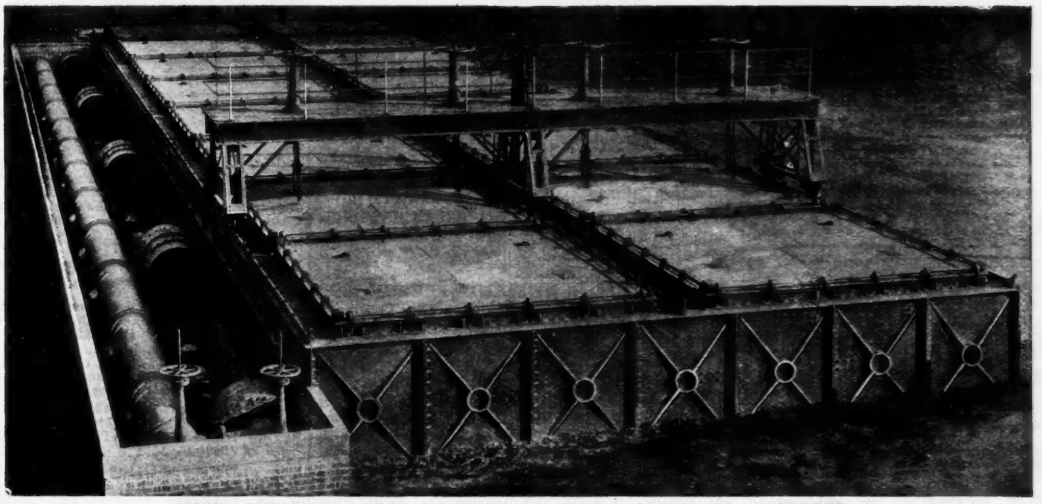

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Telephone: Barkston Ash 234 and 235 (Private Branch Exchange). Code: "Bentleys."

PLANT &c. (Second Hand) FOR SALE & WANTED

'PHONE 98 STAINES.

FOR SALE—Sectional Tank 16 ft. by 8 ft. by 4 ft.; Fuel Tank 14 ft. by 7 ft. diameter; Bucket Elevator 20 ft. Centres; 45 K.W. Steam Generator Set 220 Vo. D.C.; Three Throw Pump 5 in. by 8 in.

HARRY H. GARDAM & CO., LTD., STAINES.

FOR IMMEDIATE DISPOSAL—

Two M.S. Vertical BENZOLE SCRUBBERS, 9 ft. dia. by 37 ft. 6 in. high.
Three M.S. Vertical AMMONIA SCRUBBERS, 9 ft. dia. by 32 ft. high.
One M.S. Cylindrical Vertical GAS COOLER, 8 ft. 3 in. dia. by 28 ft. high.
One Vertical CRUDE STILL.
Two OIL HEATERS.
One CONDENSER AND SEPARATOR.
One RECTIFYING STILL by Dempster, capacity 2,500 gallons.
Two Cast Iron Vertical AMMONIA STILLS 4 ft. dia. by 19 ft. high.
One Combined COAL CHARGING, LEVELLING AND COKE PUSHING MACHINE.
One M.S. Portable COKE SCREEN.
M.S. COAL STORAGE BUNKER Brick lined. Capacity 600 tons.
Quantity of RIVETTED STEEL PIPING from 22 in., 24 in., and 26 in. bore, and 14 in. and 22 in. Valves.
Quantity of 22 in. and 24 in. CAST IRON PIPING, BENDS AND TEE PIECES.

ROBERT R. PATON, LTD.,
GARTH WORKS,
TAFFS WELL, GLAM.

WANTED—One Holmes Rotary Brush Washer Scrubber, comprising eight compartments in two bays of four compartments each, with or without inlet, outlet and by-pass connections, machine to be steam-engine driven.

Washer to be utilised for Gas Dehydration and Naphthalene Extraction capable of dealing with 500,000 cu ft. of Gas per day.

Apply No. 9032, "GAS JOURNAL," 11, Bolt Court, Fleet Street, E.C.4.

WANTED — Gasholder (for Hydrogen), capacity about 6,000 cu. ft. Write BOX L 915 WILLINGS, 362, GRAYS INN ROAD, W.C.1.

"KLEENOFF"

—THE COOKER CLEANER

Tins for Sale to Consumers. In Bulk for Works Use.

OXIDE OF IRON.

SPENT OXIDE BOUGHT.

BALE & CHURCH, LTD.

33, ST. MARY AT HILL, LONDON, E.C.3.

Telephone: Mansion House 1156. *Telegrams:* "Balefire, London."

A. E. FROST

Reinforced Concrete Engineer and Contractor

COKE BUNKERS—HEAVY FOUNDATIONS—PILING—CRANE GANTRIES — WATER TOWERS — RETAINING WALLS, etc., etc.

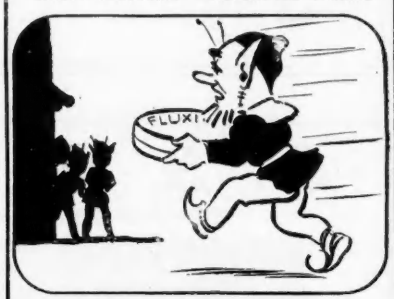
Extensive Experience of GAS WORKS Plant requirements

Estimates and schemes free of cost

14 CANNON HILL, SOUTHGATE

Telephone: Palmers Green 7017 LONDON, N.14

THE "FLUXITE" QUINS AT WORK



Cries Ee, "I've been known to forget
Quite a number of things; but I'll bet
Fifty quid to a bob
There has not been a job
On which I forgot Fluxite yet!"

For all SOLDERING work—you need FLUXITE — the paste flux—with which even dirty metals are soldered and "tinned." It does not "poison" the solder nor corrode the metal—and can be used with safety even on sensitive apparatus.

With Fluxite, joints can be "wiped" successfully that are *impossible* by *any other method.*

FLUXITE has been used for over 30 years in Government Works and by the leading Engineers and Manufacturers. OF ALL IRONMONGERS — in tins — 4d., 8d., 1s. 4d., and 2s. 8d. Ask to see the FLUXITE SMALL SPACE SOLDERING SET — compact but substantial — complete with full instructions — 7s. 6d.

Write for Leaflets on CASE HARDENING STEEL and TEMPERING TOOLS with FLUXITE also on "WIPED JOINTS."

The FLUXITE GUN puts FLUXITE where you want it by a simple pressure. Price 1s. 6d., or filled 2s. 6d.

Fluxite Ltd. (Dept. G.J.), Dragon Works, Bermondsey St., S.E.1

ALL MECHANICS *WILL* HAVE

FLUXITE

IT SIMPLIFIES *ALL* SOLDERING

(Small Advertisements Continued on page 212).

Current Sales of Gas Products

The London Market

April 22.

The present values of tar products in London are as under: Pitch, 50s. per ton f.o.b.; creosote, 5d. per gallon; refined tar, 3½d. to 4d. per gallon; the price of pure toluole under the Ministry of Supply Order is just under 2s. 5d. per gallon; pure benzole, 1s. 10d.; 95/160 solvent naphtha, 1s. 11d.; and 90/160 pyridine, 16s. to 17s., all per gallon naked; refined naphthalene crystals about £20 per ton in bags, all *ex* makers' works.

The Provinces

April 22.

Crude Gas-Works tar, 24s. 9d. to 29s. 9d.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 42s. 6d. to 47s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 42s. 6d. to 47s. 6d.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 9d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 4½d. to 1s. 5½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4½d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4¼d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 6d. to 3s. 7½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4¼d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¼d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls, whatever they may be.

Scotland

GLASGOW, April 20.

Although new business is not too plentiful, prices are well maintained.

Crude gas-works tar.—Actual value is 39s. to 40s. per ton *ex* works in bulk.

Pitch.—Production is now well looked after with value called about 40s. per ton f.o.b. for export and about 37s. 6d. per ton *ex* works in bulk for home trade.

Refined tar.—Home price is unchanged at 4¼d. to 4½d. per gallon, while for export supplies can be secured at 3d. to 3¼d. per gallon, both f.o.r. naked.

Creosote oil.—A steady throughput is maintained at the following prices: Specification oil, 5d. to 5¼d. per gallon; low gravity, 6¼d. to 6½d. per gallon; neutral oil, 5¼d. to 5¾d. per gallon; all *ex* works in bulk.

Cresylic acid.—New business is difficult and prices are rather unstable. The following may be taken as about average: Pale, 97/99%, 2s. 1d. to 2s. 2d. per gallon; dark, 97/99%, 1s. 10d. to 1s. 11d. per gallon; pale, 99/100%, 2s. 6d. to 2s. 8d. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—Business has been arranged in gas-works quality at 6d. to 6½d. per gallon, *ex* works in bulk.

Solvent naphtha is unchanged with 90/160 grade at 1s. 8d. to 1s. 9d. per gallon and 90/190 heavy naphtha at about 1s. 4d. to 1s. 5d. per gallon.

Motor benzole is 1s. 6½d. to 1s. 7d. per gallon.

Pyridine.—Supplies are short with prices nominal at 18s. to 19s. per gallon for 90/160 grade and 20s. to 21s. per gallon for 90/140 grade.

Contracts Advertised

Coal.
Rhyl Gas Department. [p. 212.]

Purifiers.
Lincoln Gas Department. [p. 212.]

Buildings, &c.
Lincoln Gas Department. [p. 212.]

Handling and Storage Plant, &c.
Lincoln Gas Department. [p. 212.]

Sulphate of Ammonia Plant.
Lincoln Gas Department. [p. 212.]

Benzole Plant.
Lincoln Gas Department. [p. 212.]

Mains.
Lincoln Gas Department. [p. 212.]

Trading Result in 1939

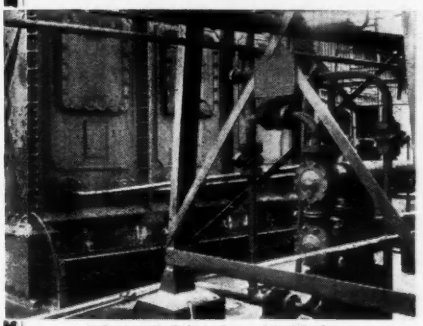
Pinchin Johnson & Co., Ltd.

Addressing the proprietors at the annual meeting of Pinchin Johnson & Co., Ltd., the Chairman (Mr. Edward Robson) said that the net profit for the year amounted to £355,546 and was an increase in actual trading profit of £68,456 on the preceding year. Sundry creditors were up by £127,000. Against this, sundry debtors showed an increase of £222,400 and stock in trade showed an increase of £63,000. These two last factors necessarily affected cash at bankers, which item showed a reduction of £110,000. The profit and loss account balance was £258,942, as compared with £179,880—which was a highly satisfactory improvement upon the previous year, bearing in mind the extraordinary conditions of the last four months of the year.

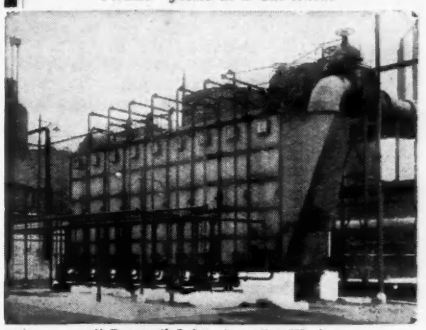
Prospects for the immediate future were dependent entirely on the requirements of the Government services, industrial activity, and export, and, concerning the latter, the Government were taking very strong steps to encourage this and the Company co-operating in every possible way. This Company was still by far the largest exporter of paint products in the British paint and varnish industry, said the Chairman, and they would like to express their appreciation of the support afforded them by the Board of Trade in their endeavours to provide the industry with adequate supplies of raw material and the elimination of restrictions wherever possible.

There's only one Permac!

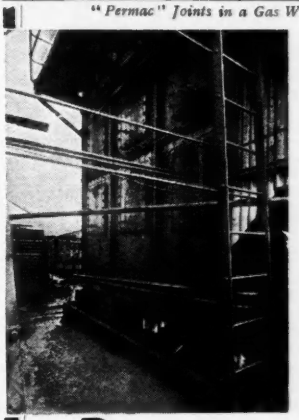
METAL-TO-METAL JOINTING MATERIAL.



"Permac" Joints in a Gas Works



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.

Be sure you get it!

Here is a selection of "Permac" joints photographed in various Gas Works. "Permac," the Metal-to-Metal Jointing, has been holding up difficult joints like these for over 25 years. Send for particulars.

Sole Manufacturers:

THOMAS & BISHOP LTD

37, Tabernacle St., LONDON, E.C.2

Telephone: Clerkenwell 3351 (2 lines)

CONTRACTS OPEN

CITY OF LINCOLN.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply, Delivery and Erection of the undermentioned, at the Gas Works, Bracebridge.

1. Four PURIFIERS, 40 ft. by 30 ft. by 6 ft. deep.
2. SUB-STRUCTURE AND ROOF.
3. OXIDE HANDLING PLANT, etc.
4. One Neutral SULPHATE OF AMMONIA PLANT, six tons per 24 hours.
5. One BENZOLE RECOVERY PLANT, to deal with 6 million cu. ft. of Vertical Retort Gas per day.
6. NEW BUILDINGS, and alterations and additions to existing buildings, and foundations.
7. Necessary GAS MAINS, TAR and LIQUOR PIPES, &c.

Preference will be given to complete Tenders for the whole of the above items.

8. Installation of VERTICAL RETORTS, capable of producing 1½ million cu. ft. of 500 B.Th.U. Gas, and new Retort House of sufficient capacity for 2 million per day plant.
9. COAL HANDLING PLANT.
10. COKE STORAGE HOPPERS, SCREENS, &c.

Complete Tenders for the above three items only considered.

All goods to be of British origin and workmanship.

Lowest or any Tender not necessarily to be accepted.

Full specification and drawings may be obtained from the undersigned.

Tenders to be delivered in plain sealed envelope to G. H. Banwell, Esq., Town Clerk, Lincoln, endorsed "Tender for Gas Plant," not later than twelve noon on Wednesday, May 8, 1940.

GEO. WRIGHT, M.I.Gas E., M.I.M.E., M.I.B.E., M.I.W.E.,
City Gas Engineer and Manager.

Gas Offices,
7, Silver Street,
Lincoln.
April 17, 1940.

RHYL URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

SUPPLY OF GAS COAL.

TENDERS are invited for the Supply of 11,500 Tons Washed Single GAS NUTS to be delivered free to Rhyl Station over a period of 12 months normally commencing June 1 next.

Form of Tender and General Conditions may be obtained from the Gas Engineer, Paradise Street, Rhyl.

Tenders to be received by the undersigned not later than May 18 next and to remain open for acceptance for 14 days thereafter.

Tenders to be delivered in plain sealed envelopes bearing no mark or indication of the Tenderer's name and endorsed "Tenders for Coal."

A. E. EDWARDS,
Clerk to the Council.

Council Offices,
Rhyl.
April 20, 1940.

PATENTS.

KINGS PATENT AGENCY, LTD.
(Director, B. T. King, A.I.M.E., Patent Agent). Advice, Handbook, and Consultations free. 146a, Queen Victoria Street, London, E.C.4. Phone: City 6161.

MEWBURN, ELLIS & CO.,
CHARTERED PATENT AGENTS
AND TRADE MARK AGENTS
70 & 72, Chancery Lane London, W.C.2.
Telegrams: "Patent, London." 'Phone: Holborn 0437
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

APPOINTMENTS VACANT

THERE is a vacancy for a TRAINED CHEMIST for the Severn Valley Gas Corporation and Gas Consolidation group of Companies. Applicants must have a thoroughly sound knowledge of Gas Chemistry and of routine laboratory work. They should preferably hold a driving license.

Headquarters—Cannock Gas Works. Salary according to qualifications. Applications to G. M. Gill, Gas Works, Cheltenham.

CITY OF SALFORD.

CONSUMERS' ENGINEER.

APPLICATIONS are invited for the position of CONSUMERS' ENGINEER in the Gas Department.

Applicants must be experienced in the inspection, fixing and maintenance of all meters and appliances. Technical knowledge and ability to organise, control and direct the work of fittings inspection, appliance fixing and systematic maintenance is essential. The successful Applicant must have initiative, together with up-to-date knowledge of the science and practice of gas supply.

Salary will be on the scale of minimum £330, maximum £440 per annum, the commencing salary being fixed according to qualifications, experience, &c.

The Salary will be subject to appropriate deduction for superannuation purposes, and the selected applicant will be required to pass a medical examination.

Applications, stating Qualifications, Experience, Age, &c., and accompanied by *copies* of not more than three recent Testimonials must be delivered to the Gas Engineer, Gas Offices, Bloom Street, Salford, 3, Lancs., not later than the first post on Monday, 6th May, 1940, the envelope to be endorsed "Consumers' Engineer."

Canvassing directly or indirectly will be a disqualification.

H. H. TOMSON, Town Clerk.

APPOINTMENTS VACANT *(continued)*

GREAT YARMOUTH GAS COMPANY.

ENGINEER AND GENERAL MANAGER.

APPLICATIONS are invited for the Position of ENGINEER AND GENERAL MANAGER to the above Company.

Make—165 Millions.

Commencing Salary, £650 per annum and House, Rates and Gas.

Applications (which will be treated as confidential) stating Age, Experience and Qualifications, accompanied by *copies* of not less than three recent Testimonials, to be addressed to the Chairman, Gas Company's Office, Great Yarmouth, and to be delivered not later than May 11.

H. C. SALTER,
Secretary.

Great Yarmouth.
April 20, 1940.

SEVERAL Home Service Advisers with demonstrating experience required immediately for Lancashire, Cheshire and Yorkshire areas. Reply stating full Particulars, Age and Salary expected to UNITED KINGDOM GAS CORPORATION LTD., Bridgewater House, Whitworth Street, Manchester 2. Endorse envelope "Home Service."

RED CROSS APPEAL

COMFORTS FOR THE SICK AND WOUNDED

In a great war the peace-time resources of the Army Medical Services must be augumented. H.M. Government has accorded the Red Cross and St. John official recognition for co-ordinating all voluntary offers of assistance throughout the Empire to sick and wounded combatants and civilians injured as a result of enemy action.

WILL YOU PLEASE HELP?

Gifts in kind will be gratefully received by Lord Ebbisham at 54, Victoria Street, S.W.1, and cash contributions will be welcomed by The Lord Mayor of London, at the Mansion House, London, E.C.4. All donations should be marked "Lord Mayor of London's Red Cross and St. John Fund." All will be acknowledged.

This space has been contributed to the Red Cross by the "Gas Journal."